News of the Industry Begins Page 811

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AUTOMOTIVE INDUSTRIES

LAND AIR WATER

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Number 21

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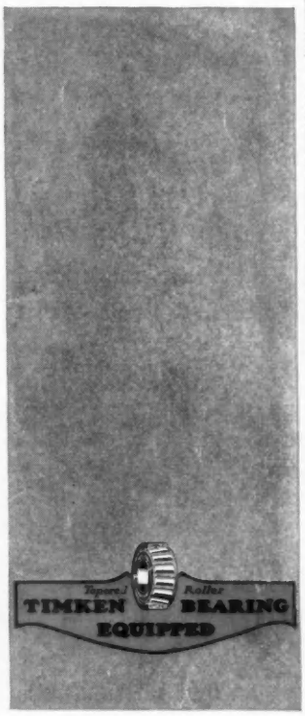

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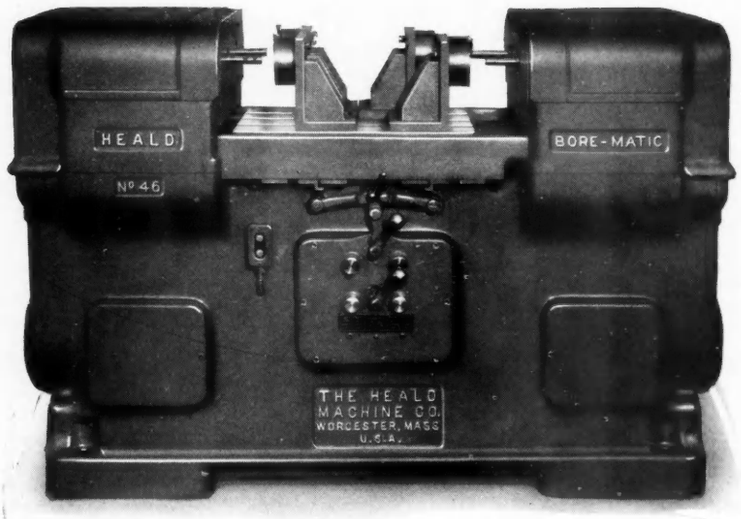

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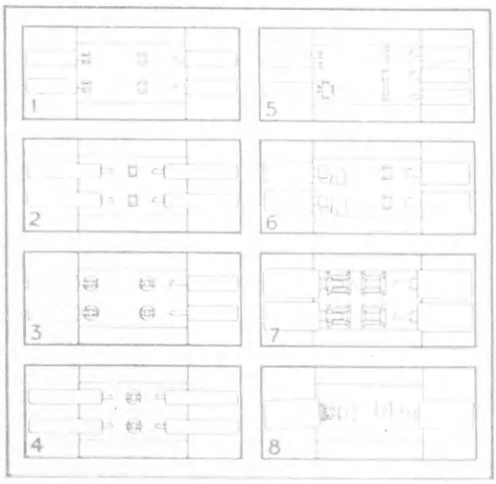

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Vol. 64 No. 21

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For the Chassis

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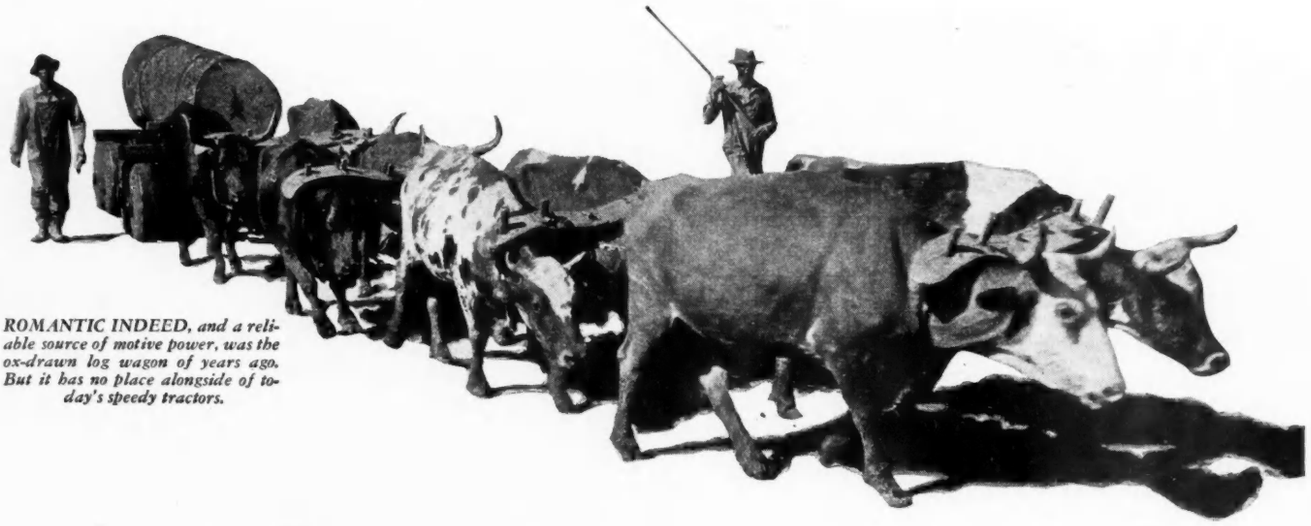

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THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE
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AUTOMOTIVE INDUSTRIES

VOLUME 64 MAY 23, 1931 NUMBER 21

Half-Year Profits to Better Dismal 1st Quarter Showing by Good Margin

by Norman G. Shidle

COMBINED earnings of a dozen important passenger car companies for the first six months of this year will be off between 25 and 35 per cent as compared to the first half of 1930.

When visioned in the light of terrific declines in production and sales, and in the face of a 45.7 per cent profit decline in the first quarter as compared to the first three months of 1930, this prediction—unfavorable as it is in itself—actually indicates a turn toward more favorable conditions for the industry as a whole.

The relative dismalness of even the low first quarter profits is lightened a little, too, by knowledge of an 85.3 per cent profit decline for 19 important iron and steel companies for the first quarter of 1931 as compared to the first quarter of 1930; a drop of 61.1 per cent for 7 electrical equipment organizations; a drop of 62.3 per cent for 12 big machinery concerns and of 90.9 per cent for 10 important textile firms.

Upturn in both production and profits began for a number of passenger car builders in the month of March, enabling several companies to turn the quarter post in the black, in spite of heavy red marks which had appeared on their ledgers for January and February. April production held particularly well for a large proportion of National Automobile Chamber of Commerce members, their total output for the month having been only about 11 per cent behind that of April, 1930.

That seasonal acceleration is going forward at a more rapid pace this year than last—even though at regu-

larly lower levels—is borne out by the Motor & Equipment Association's monthly index showing trend of original equipment sales to vehicle manufacturers. This confirming record shows an increase of 39.2 per cent in original equipment sales for March as compared with January this year; while last year a gain of only 23.7 per cent was recorded in March as compared to January. This year's seasonal acceleration in original equipment sales between January and March, as a matter of fact, was as great as in 1929, although actual sales, of course, were less than half as great.

Second Quarter Promises Better

With May reports indicating less than the normal seasonal decline in car sales, therefore, there are reasonable grounds for guessing that total profits made by passenger car companies during the second quarter will, in general, be materially better than the scant returns gathered by economies and hard work from first quarter operations.

And scant those earnings certainly were! Only $29,617,046 net earnings accrued from the combined first quarter operations of a whole dozen of the biggest passenger car manufacturers, including General Motors Corporation, but excluding Ford. Excluding General Motors, the net earnings of the other eleven were a meager $617,637.

The total is low partly, of course, because four of those eleven companies registered losses, one of them close to the million mark, thus offsetting—so far as totals for the industry are concerned—the profits earned by the other seven or eight. There is reasonable hope that combined net for the twelve companies including General Motors may run as high as $85,000,000 or $90,000,000 by the end of the second quarter.

First quarter financial performances were not uniformly bad, however, several companies having made excellent records and several others having made showings sufficiently good to permit favorable half-year totals to be turned in as a result of better second-quarter performances.

Three out of the twelve big car companies actually earned their common stock dividend for the quarter, despite the toughness of 1931 as a sales year. These were Auburn, Studebaker and Pierce-Arrow. Auburn was the only passenger car company, however, to show better profits this year than last, although Graham reduced its losses materially. Auburn, backbone of the Cord Corporation, earned $202,409 the first quarter of 1931 as against $96,623 in the similar period last year, an increase of 109 per cent, and despite drastic price reductions increased its profit per car from $16.95 to $17.25.

Failure of General Motors, Hudson, Nash, Packard, Reo and Chrysler to pile up earnings sufficient to meet first quarter dividend requirements was discouraging, to be sure, in view of the fact that the dividend rate of all these companies except General Motors is now considerably lower than it was at the end of 1929. Portents of better earnings during the second quarter, already mentioned, however, are given weight by the specific statement concerning General Motors' profit outlook recently made by John Raskob, now famed as chairman of the Democratic National Committee, but still very much a director and member of the finance committee of the giant corporation. Just before sailing for Europe a few weeks ago, Mr. Raskob stated publicly that General Motors' earnings for the first six months "are almost certain" to exceed its common stock dividend requirements by 20 per cent.

Although passenger car company dividends have gone to a much more conservative basis in the last eighteen months, disbursements during the first quarter in the form of common stock dividends exceeded actual earnings by about 33 per cent.

Nine of the 12 companies included in this analysis paid to common stockholders, dividends totaling about $39,366,000 in the first quarter of this year. The General Motors common stock payments, of course, accounted for $32,625,000 of this total, disbursements by the other eight dividend-paying car organizations having been $6,741,000.

Only one company paid a common stock dividend at the end of the first quarter while recording an actual loss for the period. Reo declared a dividend of 10c a share for the quarter, although recording a net loss of $420,832 as against a loss of $175,436 in the first three months of 1930.

A more favorable relationship between earnings and dividend disbursements seems likely during the remainder of the year, even though disbursements are maintained at their present levels. Disbursements closer to parity with earnings are certain if further reduction of dividend rates takes place.

But a number of factors are in process of combining to make earnings possibilities of passenger companies as a whole look a good bit more favorable for the rest of the year than they have for the black quarter first completed. While the weight given to specific factors would vary considerably in analyzing the outlook for any given company, the following favorable aspects appear when trying to estimate chances for increased earnings among car manufacturers in general during the coming months:

1. The worst really seems to be over from an actual sales standpoint, as indicated in previous paragraphs.
2. Personnel has been reduced to a minimum and operations in general are being conducted on a more economical basis than ever before in the history of the industry. Considerable increase in production will be possible with relatively smaller increases in personnel and costs.
3. Constantly increasing obligations for earnings in the form of stock dividends no longer exist. (Auburn is the only automobile company now paying part of its dividend in stock—and was the only company to increase its earnings this year over last, thus indicating justification for its being an exception to the general rule at this time.) Hence, any actual increases in earnings automatically register as increases in earnings per share.

Enemies to Better Earnings

Important enemies to better earnings on the part of the motor vehicle industry as a whole, of course, are heavy investments in plants whose full productive capacities give no signs of being needed again for several years to come. While exact estimates of production capacity are impossible, it is probable that, if pressed to do so, the passenger car makers of the United States could build nearly three times as many automobiles this year as retail demand will permit.

While excess production capacity has existed for some years past, the industry as a whole for the first time is seriously faced with the problem of earning a fair return on capital invested.

The motor vehicle makers have earned about 15 per cent on invested capital (exclusive of funded debt) during the five years 1926 to 1930, inclusive.

Profit and Loss Statistics, Earnings Per Share and Earnings Per Car

COMPANY	NET PROFITS					Yearly Dividend Rate	EARNINGS PER SHARE				Approx. First Quarter Production		% Gain or Loss	1st Quarter Earnings Per Car	
	First Quarter 1930	First Quarter 1931	% Gain or Loss 1/4 1931-30	First Half 1930	12 Months 1930		First Quarter 1930	First Quarter 1931	1st Half 1930	12 Mos. 1930	1930	1931		1930	1931
Auburn*	$96,623	$202,409	109.0G	$866,008	$1,018,300	$4.00	$0.56	$1.06	$4.81	$5.43	$5,700	$11,700	105.0G	$16.95	$17.25
General Motors	44,968,587‡	28,999,409‡	35.0L	98,355,355‡	151,098,992‡	3.00	.98	.61	2.15	3.25	322,500	253,800	21.3L	139.43	114.26
Graham	—489,480	—175,000	..	—880,960	—4,969,320	..	—.34	—.15	.62	3.09	10,500	6,500	38.1L	—47.60	—26.90
Hudson	2,316,945	226,395	90.2L	3,392,012	324,656	1.00	1.45	.14	2.12	.20	54,100	22,400	58.6L	42.75	10.10
Hupmobile	66,749	—680,911	1120.0L	509,053	—922,765	..	.04	—.45	.33	—.61	7,500	5,800	22.7L	8.90	—117.40
Nash*	1,782,512	1,099,194	38.3L	3,715,408	7,601,164	4.00	.65	.40	1.36	2.78	14,900	10,700	28.2L	119.80	102.50
Packard	2,654,247	113,004	95.7L	5,528,837	9,034,219	.40	.18	.01	.37	.60	8,000	2,900	63.8L	331.00	39.00
Reo	—175,436	—420,832	..	—349,397	—1,989,148	.40	—.09	—.21	—.17	—.99	4,100	1,600	61.0L	—42.70	—262.00
Studebaker	1,343,427	809,750	39.7L	2,258,702	1,000,216	1.20	.62	.36	1.03	.28	6,900	14,100	104.0G	195.00	57.30
Willys-Overland	136,443	117,106	14.2L	151,704	—7,588,392	..	—.04	—.39	—.12	—2.85	26,500	20,200	23.8L	5.13	5.80
Chrysler	180,717	—979,927	640.0L	3,408,856	234,154	1.00	.04	—.22	.77	.05	69,100	49,600	28.2L	2.61	—19.75
Pierce-Arrow	461,401	306,449	33.6L	1,030,678	1,317,071	1.00	1.77†	1.01†	4.09†	4.40†	2,300	1,500	34.8L	200.00	204.00
TOTAL (Less Gen. Motors)	10,373,148	617,637		17,986,256	5,060,155										
TOTAL (Inc. Gen. Motors)	$55,341,735	$29,617,046		$119,216,613	$156,159,147						$532,100	$400,800		$103.90 (Aver.)	$73.90 (Aver.)

* Quarter ended Feb. 28.

† On class A common.

‡ Includes equity in undivided profits or losses of subsidiary or affiliated companies not consolidated.

What the First Quarter Showed—

First quarter financial performances were not uniformly bad.

Several companies made excellent records and others made showings sufficiently good to permit favorable half-year totals as a result of improved second quarter performances.

Three out of 12 big car companies actually earned their common stock dividend for the first quarter.

What We May Expect—

A more favorable relationship between earnings and dividend disbursements seems likely during the remainder of the rear.

Disbursements closer to parity with earnings are certain if further reduction of dividend rates takes place.

There is reasonable hope that combined net for the 12 companies (see table) may run as high as 85 or 90 million dollars by the end of the second quarter.

We've Turned the Corner—

The automobile business has turned the corner.

Its upward trend will be slow.

Those who are to cash in first on prosperity, when it does approach fruition, will be those whose eyes have not remained blinded by the sleep of pessimism too long after the early buds of better business have begun to show themselves to the more alert observers of business conditions.

Their best performance, as might have been expected, was in 1929, when they earned 18.8 per cent on invested capital (exclusive of funded debt) and their next best in 1926, when 18.2 per cent was earned. The earnings on invested capital by years run as follows:

1926	18.2%
1927	14.6%
1928	15.6%
1929	18.8%
1930	8.9%

The companies whose figures were combined to obtain these totals were Auburn, Chrysler, Ford, General Motors, Graham, Hudson, Hupp, Nash, Packard, Peerless, Pierce-Arrow, Reo, Studebaker and Willys-Overland.

What the figure for 1931 will be only time will tell, but that it will be materially smaller than the 8.9 per cent registered as a new low in 1930 seems certain. Capital investments, while subject to some downward readjustments during a depression period, cannot be lowered with anything like the speed or facility of other expense items; nor would sound business judgment warrant hasty elimination of plants, machinery or equipment which, in the case of individual concerns, is certain to be needed later when business again attains normal levels.

In the meantime, however, the fact remains that the problem of earning satisfactory returns on capital investment is tougher for the passenger car business as a whole than at any time since it achieved its place as a leading manufacturing industry. In this one respect, its difficulties probably are greater than those of the older and longer established industries.

Even when one looks squarely in the face the sad facts revealed by the earnings statements of passenger car companies for the first quarter of 1931, however, no sound basis is revealed for permanent pessimism as regards the future earning power of this great industry. Wall Street, with its usual habit of overemphasis either on the side of optimism or pessimism, seems at present to be delighting in a sort of economic sadism with reference to business in general and the automobile business in particular. Automobile factory sales managers returning with renewed confidence and optimism from weeks spent in close contact with the retail trade have only to spend a day or two in New York to have much of their now well-founded optimism dissipated in the financial fog which still seems to enwrap Gothamites.

And it is natural that much of this determined gloom-thinking should enter the hearts of automotive executives, many of whom, after all, spend a lot more time in sessions with other of their kind than out in personal contact with business where it actually is being done—in the dealer establishments and independent repair shops of the country. As a result, it is probable that many of the financial statements being issued this year are more conservatively built than at any previous time.

It's just about safe to say that whatever is shown by these first-quarter statements, conditions are no worse than indicated—and that probably conditions are better than indicated. Two years ago—even one year ago—such a statement wouldn't have been warranted by the facts. Today it is. One cannot travel through the industry talking to various executives in the different plants without sensing an almost sadistic or masochistic determination to enjoy economic punishment, either of others or themselves.

This is a psychological phase that is bound to pass; a mental darkness that gradually must retreat before the slow but steady march of business improvement. In the meantime, sane men will realize that the feeling of business men about the progress of business is almost certain to run behind the development of prosperity itself, just as, in 1929, their feeling as regards the utter impossibility of a depression ran far behind clear signs of the imminence of just such a depression.

The automobile business has turned the corner. Its upward trend will be recorded in relative rather than actual terms for many months to come. Its progress will be slow. But those who are to cash in first on prosperity when it does approach fruition will be those whose eyes have not remained blinded by the winter sleep of pessimism too long after the early buds of better business have begun to show themselves to the more alert observers.

Tolerances on Angle Between Cylinder Bore and Crankshaft Axis

THE German Automobile Standards Committee was recently asked by an automobile manufacturer as to what is the permissible tolerance on the 90-deg. angle between the cylinder bore of an internal combustion engine and the crankshaft axis or the finished surface of the crankcase to which the cylinder is secured. The committee's inquiry led to the following:

In the production of single-cylinder engines, particularly motorcycle engines, it is considered unnecessary to set a tolerance on the deviation from the 90-deg. angle between the cylinder axis and the crankshaft axis or the joint surface between the crankcase and the cylinder, as very close machining of the parts in question, such as cylinder bore, mounting surface of crankcase, and connecting rod bearings, is possible. In most cases, after the bore has been completed, the cylinder is mounted on centers and the mounting surface of the bottom flange is then checked as to perpendicularity. The crankcase also is carefully inspected after it is completely machined. After the crankshaft has been assembled with the piston and connecting rod, it is checked for angularity.

An investigating service claims it is often found that one-sided wear of pistons and piston rings is due to the fact that the connecting rod has been kinked or bent. Misfires or backkicks of the engine while starting, scraping of the flywheel on bad roads or in case of defects, stalling of the engine in case of a seized piston or breakage of a piston ring are the causes in many instances. It is also a matter of great importance whether the crank is in a single piece or built up, as with cranks of the latter type pistons showing excessive wear on one side are quite common.

In the case of multi-cylinder engines it is impossible to get along without a tolerance on the angle between the cylinder bore and the crankshaft axis or the cylinder mounting surface on the crankcase. These tolerances are particularly difficult to adhere to when the cylinder block and the crankcase are separate castings. In the case of an eight-cylinder engine in which cylinders and crankcase are in one block it is customary to limit the tolerance on the perpendicularity between cylinder bore and crankshaft axis to 0.0004 in. on the length of the cylinder bore, say 8 in.

JUST AMONG OURSELVES

And the Greatest of These Is—

AT the base of the statue of Lafayette, which stands in the campus of Lafayette College, appears the following quotation of words once spoken by that famous man.

"I read, I study, I examine, I reflect, and out of these I try to form an idea into which I put as much common sense as I can."

* * *

Petty Plea of Railroads Brushed Aside

GOV. FLOYD B. OLSEN of Minnesota has vetoed a bill which would have prevented common carrier truck companies from charging rates lower than railroads where trucking operations parallel rail lines. Answering pleas of railroad employees for passage of the bill he said:

"To attempt to insure the continued employment of railroad employees by regulating 233 trucks compared with over 100,000 unregulated trucks is like attempting to stem the tide of the seas."

* * *

Truck Operation Is Adjustable

CERTAINLY the fluidity and flexibility of truck operation is its armor and its shield as well as its greatest contribution to transportation efficiency. Probably never has this peculiar quality of motor transport been more deftly portrayed than by Thomas H. McDonald, chief of the U. S. Bureau of Public Roads, at an Interstate Commerce Commission hearing a few months ago. Said McDonald:

"Motor transport of all kinds fits into a very definite field that cannot be filled by either the railroads or the waterways or the airplanes, and it is so flexible that any uneconomical regulation only succeeds in denting it at one point and bulging it at another. . . . You may pick up a handful of molasses, but it is impossible to hold it, because it will squeeze out through the fingers when it gets warm. It is this extreme flexibility of motor transport and the fact that it fits into a definite place in our scheme of transportation that will defeat any uneconomical regulation, because it will change over into some other type of utilization and that is reflected in all studies of highway transport."

* * *

Magic is a Poor Mainstay

IF Mr. McDonald is right, the truck industry need not fear the rising tide of adverse, uneconomic legislation which some have thought might engulf the truck business. Truck hauling may be the Houdini of the transportation field, everlastingly able to perform magical escapes from locking and binding legal restrictions. It has in the past and it will in the future. But it wouldn't be wise to sit back and let its tormentors try its powers too far. After all, Houdini was an exception.

* * *

The Pen Needs Some Backing

HOW easy it is to agree on generalities. And how hard to agree on specific definitions of meanings. Take the following:

"The nation must recognize that its economic welfare in the future depends on a modern and coordinated system of transportation, and that only a long look ahead, and an earnest and intelligent survey of present and future policy with respect to the development of the several agencies of transportation will preserve the most effective agencies in full vigor, and will enable them adequately to meet the demands for transportation service."

Who wrote that? A big shipper of goods? He might have.

A representative of the motor truck division of the N.A.C.C.? He might have.

A Senator or a Representative in Congress? He might have.

A representative of the railroads? He might have—and in this case it happens he did.

It just happens, in other words, that the quotation is from "A Review of Railway Operations in 1930," published by the Bureau of Railway Economics. But any of the competing groups might have issued it as their own propaganda. Why then can't everybody agree?

They can—so long as action, with the concomitant necessity for interpretation, isn't insisted upon. But until interpreted in action, what of it?—N.G.S.

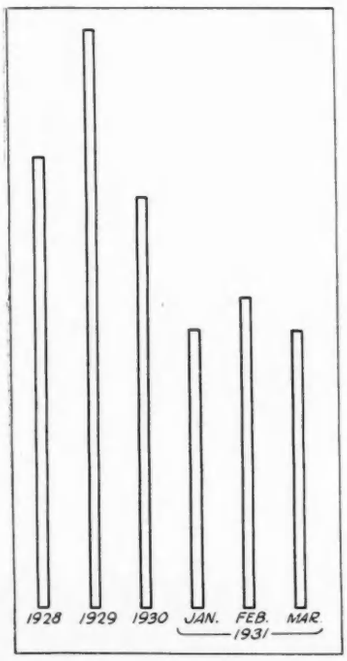
Reports of Standards Committees Share Meeting of Gear Makers

OF THE three technical papers presented at the annual meeting of the American Gear Manufacturers Association at Buffalo recently, two dealt with research on the stresses in gear teeth, while the third was of an industrial character, dealing with the subject of non-metallic gears in a general way. Reports were presented by numerous divisions of the general standardization committee and a whole day was devoted to commercial practices, such as cost determination, the standardized quotation sheet, etc.

As mentioned in our last issue, the Association has begun to gather statistics on production in the gear industry, and a graph showing the average monthly production during the years 1928, 1929 and 1930 and during January, February and March of this year is reproduced herewith. The chart is based on returns from about 20 per cent of the member companies, hence it may not be an absolutely accurate picture of the activity of the industry as a whole, but it is hoped to gradually induce all of the member companies to furnish figures for the compilation.

Revised Standards Program

A. A. Ross, chairman of the general standards committee, presented a revised standardization program. The original standardization program was adopted in June, 1921, at which time a list of items to be dealt with by each sub-committe was set up. This program was revised in January, 1924, and again in January, 1931, and in the report submitted by Mr. Ross it was shown what action had been taken on the various items in the program of each sub-committee and which subjects were still awaiting action.



Comparative values of monthly production of gears of all types

Research Committee Reports

Professor Earle Buckingham, of M.I.T., reported for the A.G.M.A. research committee on gears. He said they had quite recently completed a research on non-metallic gears, in which two sets of gears had been used, one of the conventional form and the other of the type in which the teeth are all addendum. They tried to get some idea of the load at which surface failure takes place. On the "all-addendum" form of gear the load was run up to 2-2.5 times the rated load before any signs of surface disintegration appeared. The breakage loads were about the same for both types of gears. There is thus little difference as regards the "beam strength" of the two types, but the surface strength seems to be materially greater with the "all-addendum" gear.

At present, tests are being run on gears made of various kind of semi-steel. It appears that in the higher types of semi-steel, in which more than 50 per cent of steel is added to the cast-iron base, the modulus of elasticity attains values of 28 to 29 million lb. p. sq. in., thus approaching steel in this respect, while cast iron and ordinary semi-steel have moduli of elasticity

Honors with Technical Papers at Annual

by P. M. Heldt

of between 13 and 14 million pounds. Another line of work that has been carried out at M.I.T., and which was covered in a paper presented by Professor Buckingham at the Saturday morning session, led to the conclusion that with metallic gears the increment load on the teeth resulting from shocks due to inaccuracies are practically independent of the transmitted load. It is now planned to make tests, in collaboration with the U. S. Navy, to determine whether a similar law holds for ball bearings.

Tolerances Discussed

In connection with the report of the library committee, which was presented by M. T. Schumb, there was some discussion as to the tolerances required on gear dimensions. Mr. Ross thought that the proper tolerances would have to be determined for each kind of gearing by the respective sub-committee. Professor Buckingham said that in testing the numerous gears which were furnished the research committee for its work he had found that the cumulative error generally amounted to about 0.002 in. in gears of 12 to 6 diametral pitch, and to about 0.004 in. in gears of 2 pitch. The cumulative error, on which depends the change in velocity ratio, is the most important factor. The shocks occasioned by inaccuracies also depend upon the speed of operation, and since the shocks vary as the squares of the speeds, it may be necessary to have three grades of accuracy. There are then two ways of going at the problem, the first being to determine the maximum error permissible for a certain speed range, and the second to determine what degree of accuracy can be commercially attained. If specific tolerances were to be set for any class of gearing, they should be on the cumulative error and not on the individual elements, such as bore, eccentricity, spacing, etc., as the error in tooth action depends on the former.

Non-Metallic Gears

C. W. Mansur, of the General Electric Company, read a paper on "Non-Metallic Gears and Their Operation Characteristics," in which he dealt both with the compressed cotton gear sold under the name of Fabroil and gears made of fabric material impregnated with synthetic resins. Fabroil is made of unspun cotton such at batten. The cotton fibers are laid by means of a special machine and treated with oil, and they are then subjected to a pressure of from 8-9 tons p. sq. in. Each gear is provided with steel shrouds or end plates and the whole is held together by means of rivets. Thousands of these gears were sold to automobile manufacturers for timing gears, but owing to their weight and shroud limitations they were later replaced by gears made of fabric-resin material.

Mr. Mansur also discussed the latter type of gear at some length and said that the raw material, that is, the fabric, when coated with the resin, must be free from solvents, moisture and other gas-forming fluids

Professor G. M. Bartlett, of Purdue University, reported for the sprocket committee, of which he is chairman. This committee plans to add nine items to its program, including the following:

Uniformity in character of specification sheet.

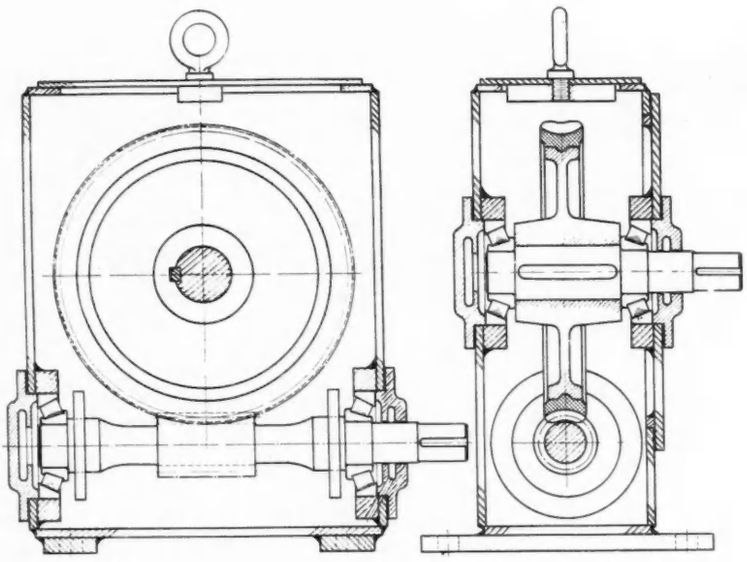
A table of load factors for use in connection with the horsepower and the working-load table in the present A.G.M.A. standard.

Uniform instructions regarding the selection of chain drives.

Hubs, bolts and bolt holes for Type D (detachable) sprockets.

Table of maximum chain velocities.

A simple chart for the selection of chain drives.



Experimental unit used to determine load capacity of worm gears + +

before it is pressed into gears or gear material.

It is also very important that all of this material be heat-treated thoroughly after molding to remove stresses due to high pressures and to shrink the material to an unchangeable condition. This is to prevent any change taking place in the accurately cut gear after it is installed in an automobile engine, etc.

It is very important that non-metallic gears be properly aligned. There are many installations where improper fastening of the motor to the frame of the machine causes short life and failure. Although a non-metallic gear has a relatively flexible tooth which will compensate for slight inaccuracies of both cutting and mounting, there are, of course, limits to the errors which can be thus compensated for.

Non-metallic pinions with "all-addendum" teeth have been used in many recent installations, in accordance with the recommendation made by Professor Buckingham in his paper presented a year ago, with what appears to be a marked improvement in operation, but sufficient data have not yet accumulated to say from experience just what results may be expected from this method of cutting.

In the discussion of Mr. Mansur's paper, W. H. Himes, of the Westinghouse Company, emphasized the advantage due to the low modulus of elasticity of phenolic materials, which results in distributing the tooth load over a greater number of teeth, but Professor Buckingham pointed out that owing to inevitable inaccuracies in teeth the distribution is not uniform between the different pairs of teeth simultaneously in contact. For instance, in a gear with a cumulative error of 0.002 in., before the second pair of teeth comes in contact the first pair is already stressed to the elastic limit. Gears of phenolic materials are at their best in high-speed installations, and their use in low-speed work is not always warranted, as the strains in starting up may prove excessive.

Worm Gear Test

At the Thursday evening session W. H. Himes, as chairman of the worm gear committee, presented a report for that committee in which he dealt with further results on the experimental worm-gear-type of speed reducer built by his company. A drawing of the test unit is shown herewith. According to formulae for worm-gear load capacity found in various enginering handbooks the set should be able to carry loads ranging all the way from 2.5 to 16.75 hp.

In these tests the casing of the speed reducer was filled with oil (600-W) to completely cover the worm gear, this being made possible by the use of oil seals on the driven shaft (Gits Braders "precision oil seal" and Chicago Rawhide "perfect seals"). Test runs of considerable duration were made with loads of 25 and 30 hp., and temperature observations during these runs are given in the chart reproduced herewith. At the end of these runs the gearing was carefully examined and no signs of pitting were found. Also, no signs of oil leakage were noticed, hence the oil seals functioned satisfactorily up to this time.

The load was increased in steps until finally at 48 hp., after 22 hours' continuous running, there were signs of increasing pitting, and the conclusion is drawn that the maximum load under which this unit will stand up is 45 hp. In the earlier part of the tests it was feared that the oil temperature would rise so high that the roller bearings would lose their temper, but tests carried out by the Timken Roller Bearing Company convinced that company that it could guarantee that its bearings would not be injured by temperatures up to 300 deg. F. The inside bores of the oil seals were subjected to a rubbing speed of 580 ft. p. m. and they functioned satisfactorily during the entire test.

Following are data of the test units employed in these tests: Case I: Ratio, 14 to 1; center distance, 7.926 in.; worm, four threads, ¾-in. pitch, 3-in. lead; 2.483-in. pitch diameter, 2.960-in. outside diameter, 21 deg. 2 min. lead angle, 14½ deg. axial pressure angle, made of S.A.E. No. 1020 steel, case hardened; threads ground. Wheel, 56 teeth, ¾-in. circular pitch, 2-in. face width, made of S. A. E. No. 65 phosphor bronze, which has an ultimate strength of 40,000 lb. p. sq. in., a yield point of 25,000 lb. p. sq. in., an elongation of 11.75 per cent and a reduction of area of 11.8 per cent. The teeth of the wheel were hobbed and lapped in with the worm. Case II was similar except that the wheel had 57 teeth, giving a ratio of 14¼ to 1.

Mr. Himes was asked whether he had used different lubricants to see what the effect on the load-carrying capacity would be, and his answer was that he had not; that he had purposely refrained from changing more than one variable at a time. Moreover, he considered such tests useless in this connection because he felt that 600-W would be used for worm gearing no matter what the manufacturer might specify, the implication seeming to be that such units could not well be rated at a higher load than they would safely carry when lubricated with this oil.

Mr. Himes also asked in what direction the members wished the tests to be extended, and the consensus of opinion seemed to be that they should be extended in the direction of higher worm speeds, since the general

tendency in prime movers is unmistakably toward higher speeds. The general conclusion drawn from the investigation carried out so far is that the present formulae for worm-gear load capacity give too low values and should be suitably revised.

Nomenclature

D. T. Hamilton presented the report of the nomenclature committee, which embodies a complete nomenclature for gearing of all types including 118 terms with symbols, abbreviations, definitions and illustrations, and in a few cases equations, where these help to explain the meaning of the term.

Keyway Practice

R. B. Zerfey, chairman of the keyway committee, made a report in which proposed certain additions and revisions of the present A.G.M.A. recommended practice. The addition related to keys for very large bores (18 to 21 in.) to bring it more closely in line with the mathematical rule on which the sizes are based. The new revised recommended practice, which was adopted, differs in two particulars from the proposed keyway standard now before the American Standards Association.

Contact Stresses

A paper on Photoelastic Study of Contact Stresses in Gears, by R. V. Baud, of the Westinghouse Electric & Mfg. Co., was read by E. Hall. The author of the paper since 1925 has made extensive studies of fillet stresses in gears by the photoelastic method, and he considers pioneer research in this line completed. The subject of contact stresses was taken up by him late, and in a paper presented by S. Timoshenko and the present author to the A.G.M.A. in 1926 basic equations for these stresses were reviewed. Two years later Mr. Baud derived the complete stress equation for a line perpendicular to the gear tooth profile at the point of maximum contact stress, which he calls the contact center line. No experimental work on this point was done until 1930. The main object of the experimental work covered in this paper was to find the fillet stresses for different positions of contact, one tooth carrying the entire load. The mathematical investigation is based on the Hertz equation for the stress at the center line of contact when two rollers of elastic material are being pressed together, and Mr. Hall said the photoelastic tests had shown the validity of the use of the Hertz equation for determining tooth contact stresses.

Tooth Form

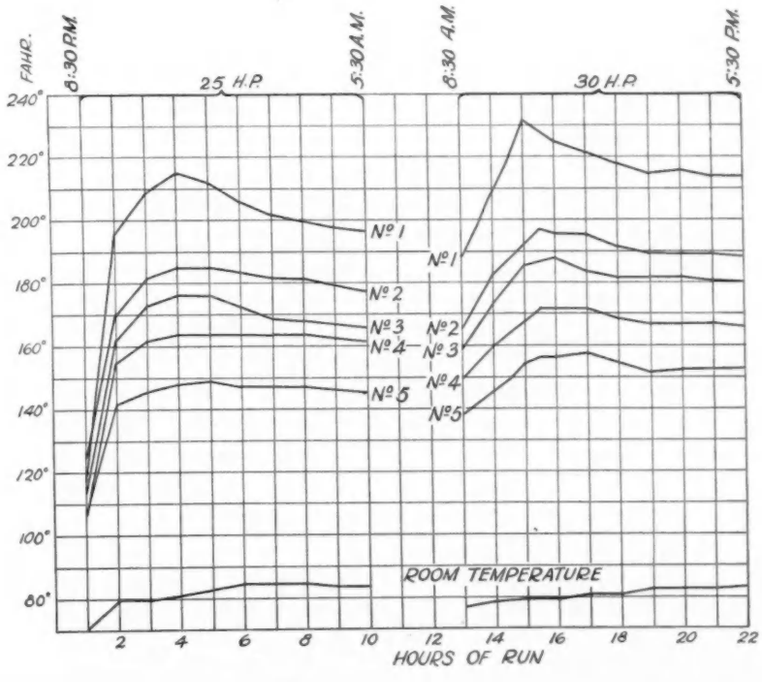
The Tooth Form Committee, through T. R. Rideont, had sent out a questionnaire to the membership on the subject of tip relief. The answers received to this had revealed many differences of opinion, but practically all were agreed that some form of tip relief was necessary. Most gear manufacturers do not specify any particular tip relief but leave the matter to the hob manufacturer supplying them. Mr. Rideont had prepared two charts showing respectively the circumferential and the radical corrections resulting from the various forms of tip relief now in use. From the curves of these charts he concluded that standardization of tip relief is necessary, but before it can be accomplished the whole subject must be thoroughly analyzed from both the theoretical and practical standpoints, and it is planned to have R. E. Peterson, of the Westinghouse Electric & Mfg. Co. Research Laboratories, make a thorough study of the deflection of teeth and the deformation of material under load during the next six months and present at the fall meeting of the A.G.M.A. a paper dealing with his results.

F. W. England, chairman of the gear inspection committee, presented a revision of the Recommended Practice on inspection methods which was based on criticisms passed on the old Recommended Practice by various members. The "inspection of Gears" was entirely rewritten and such items as Disputes, Thread Inspection, External Threads, Internal Threads, Steel Castings, Steel Forgings, Iron Castings and Brass and Bronze Castings were omitted. A recommended practice for gear inspection was defined as a statement of

What to check for
How to check it, and
What equipment is available for the purpose.

In accordance with requests from many members, photos and drawings of inspection tools were included, as were some diagrams showing the use of these tools.

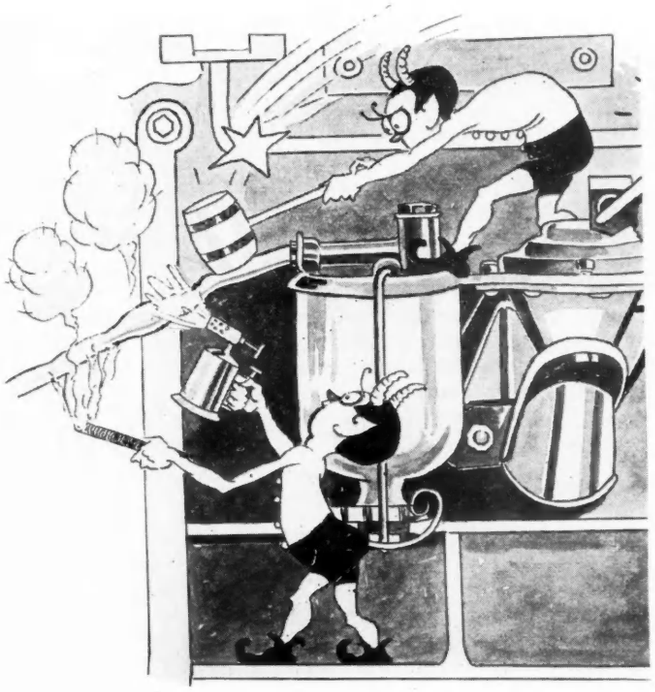
In the discussion following the presentation of this report attention was called to a number of gear inspection devices not included in it, and Mr. England invited information regarding them.



Temperature variations with time
(No. 1, at bottom of case; No. 2, at worm-wheel bearing; No. 3, at worm bearing; No. 4 at top of case, coupling side; No. 5, at top of case, free side)

Designers Must Cool Hot Spots in Fuel

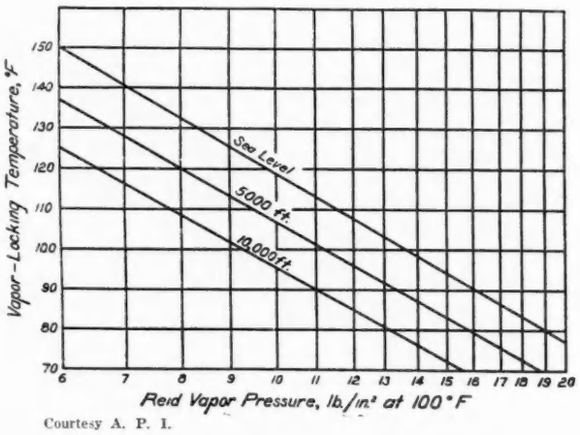
by Joseph Geschelin



VOLATILE gasolines—the answer to an automobile world's prayer—are here in numbers. Availability of huge supplies of natural gas, widespread use of cracking processes, and finally the advent of hydrogenation, assure an abundance of gasoline with lots of pep, easy starting characteristics, better distribution, good knock rating*—and vapor lock. Why this last-named factor has been permitted to change a perfectly fine formula into a mathematical inequality threatening to hamper the use of volatile gasoline, has been the subject of much speculation, indifference, or contempt, depending upon one's interests. And it is the purpose of this article to present the results of an investigation of this phase of the subject.

A visit to a large number of Eastern refiners and interviews with practically every member of the cooperative fuel research steering committee representing the S.A.E., A.P.I. and N.A.C.C. left the writer with a vivid impression of highly competitive units of an industry getting together to solve a mutual problem with a full realization of the responsibility involved. The results are history now. Studies of the vapor lock problem, volatility, and related factors of operation, have been freely and frankly broadcast, gasoline specifications have been changed wherever necessary and extensive changes in production methods and equipment put through wherever required. O. C. Bridgeman's work at the Bureau of Standards, with which every one now is familiar, has been instrumental in the solution of many fundamental problems. Since vapor lock is largely a function of under-the-hood

* "Production of Gasoline and Lubricants by Hydrogenation," by Haslam and Bauer, S.A.E. Journal, March, 1931.



Courtesy A. P. I.

Fig. 1—Relation between Reid vapor pressure and vapor-locking temperature at various altitudes

Refiners are producing highly volatile fuels to meet demands for easy starting

These gasolines tend to vapor-lock and consequently stall many cars built today

It's up to engineers to design car and truck engines which will not vapor lock

Here is an article which explains the problem simply, and gives common-sense remedies

Lines to Defeat Deviltry of Vapor Lock

temperature and specifically of maximum temperatures in the fuel system, the most important part of Bridgeman's work is the measurement of fuel line temperatures of automobiles on the market today. The limitations imposed by these temperatures have been accepted by gasoline refiners all over the country.

Another corollary of the work of the cooperative research committee is that propane, which will be discussed later, is now definitely controlled. Practically all refiners are holding propane contents below one half of one per cent, and, in at least one case in the East, gasoline is being produced propane free. Incidentally, many refiners are experimenting with stabilizing equipment to eliminate propane so that ultimately volatile gasolines will be freed of this disturbing element.

Briefly, the present status of vapor lock is this: all the facts are known and the refiners feel that no more fundamental research is necessary. With what is known about fuel line temperatures of cars on the road today, the refiners have set up limiting specifications designed for certain average operating conditions. These specifications are closely controlled and are varied with seasonal changes.

Now the disturbing thing about the whole situation is that not all automobile designers will take it seriously. Strangely enough there seems to be an attitude of complacency born of the fact that everything about vapor lock and the means for controlling it is well known.

Unquestionably the feeling that all is quiet on the vapor lock front is shared by some petroleum technologists as well as many automobile designers because of the apparent lack of service complaints. As a matter of fact, competent observers have found a serious condition prevailing. It is annoying and sometimes dangerous on passenger cars; very expensive as well as annoying in bus and truck operations; and decidedly hazardous on air-

Insulation of fuel line, pump and carburetor from excessive heat should be considered if engine-stalling, due to vapor lock, is to be controlled

Better ventilation under the hood, locating or keeping the fuel system as far from exhaust manifold as possible, will overcome many troubles due to highly volatile gasolines which are demanded today

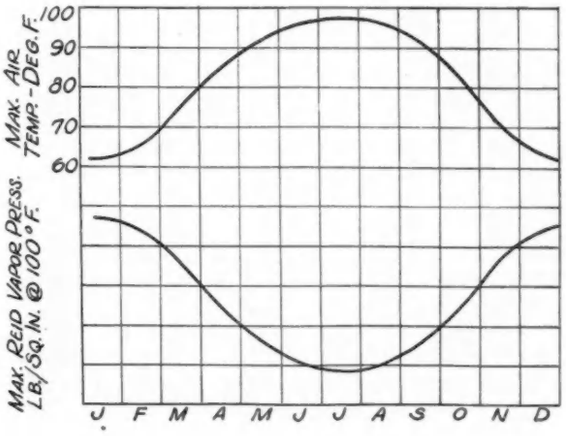


Fig. 2—Fuel specification control used by the Atlantic Refining Co. for Philadelphia and vicinity + + + + + +

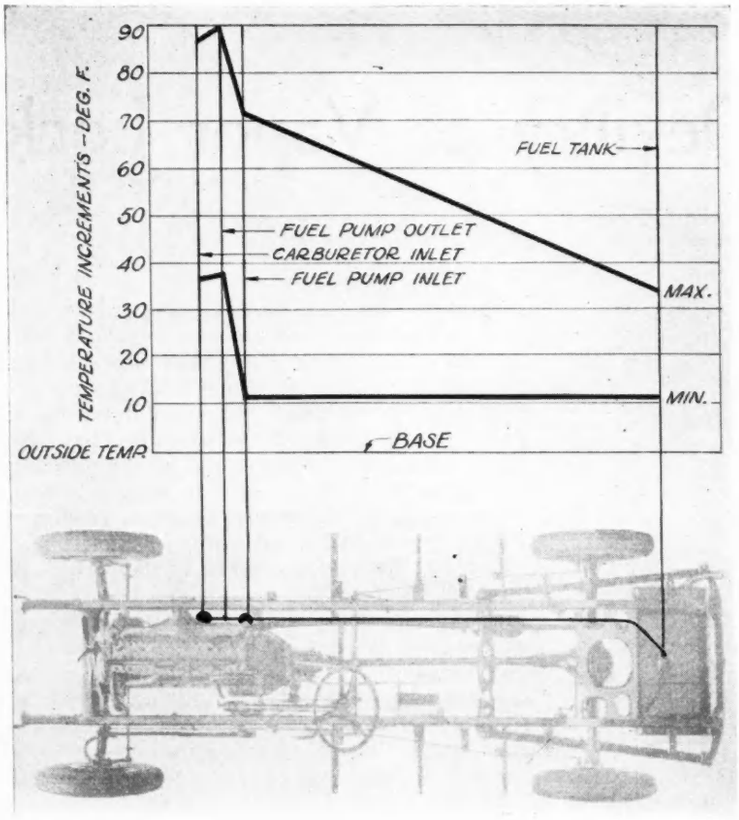


Fig. 3—Temperature gradients in fuel feed system from results of cooperative fuel research work. Values based on Table 2, idling after 40 m.p.h.

craft. Yet slight modification in the disposition of fuel lines, carburetor and fuel pump can scratch vapor lock from the list of operating hurdles.

Vapor lock manifests itself in many ways, some obscure. Perhaps the best statement of the problem is made by Bauer.* He identifies vapor locking with four distinct effects:

1. Stalling or uneven running upon idling after hot run.
2. Stalling or uneven running upon idling in slow moving traffic.
3. Occasional stalling at sustained high speed.
4. Intermittent or uneven running during acceleration immediately after idling.

Stalling due to vapor lock in the carburetor occurs in two distinct ways depending upon design:

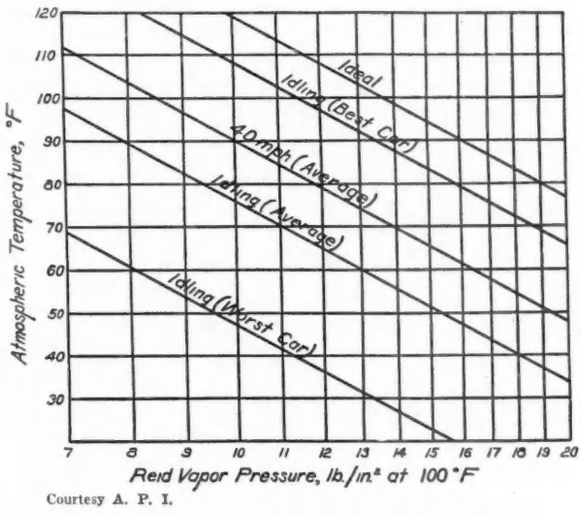
1. Too lean mixture with a plain tube carburetor.
2. Too rich mixture with an air valve carburetor.

Complete stoppage following which the engine will not start with the starter is due to fuel lock ahead of the carburetor.

So much has been said about vapor lock by various experts that the mechanics of it is well understood by everybody. But there are a number of things involved that are not so well understood except by technologists, and we propose to dwell on these very briefly. Edgar, Hill and Boyd thought enough of this to collaborate on a paper† which was read at the A.P.I. annual meeting, 1930. Of all the technical terms used in connection with motor fuels, just two or three are really important to the automobile designer. These relate to ease of starting and tendency to vapor lock. In the present state of the art, the 10 per cent evaporated temperature is the index of starting characteristics. This specifies the minimum volatility of the fuel, and any compromise will affect starting. The second factor is Reid vapor pressure expressed in lb. per sq. in. at 100 deg. F. It is only recently that these factors have been stressed to any great extent and were included for the first time in the Bureau of Mines Twenty-second Semi-annual Motor Gasoline Survey published December, 1930.

The second factor is a rather reliable index of the vapor locking tendencies of fuels. And now, the exact relation between Reid vapor pressure and vapor locking temperature has been carefully worked out both experimentally and in field tests and is shown in Fig. 1 taken from Bridgeman's paper** read at the A. P. I. meeting April 15, 1931. By means of this chart it is possible to predict the vapor locking temperature of any gasoline from the distillation data.

We must emphasize that these two factors are precisely the minimum and maximum limits of volatility and constitute the range within which the refiner has to work. We emphasize this because only the 10 per cent point was previously used in vapor lock investigation but had to be abandoned in favor of vapor pressure because of the disturbing effect of propane. Bridgeman's last paper indicates that one per cent propane increases vapor pressures 2 lb. per sq. in. at 100 deg. F. and lowers the boiling temperature by about 15 deg. F. for a gasoline having a vapor pressure of 8 to 10 lb. per sq. in. at 100 deg. F. Gasoline boils at the 10 per cent evaporated temperature at atmospheric pressure only when propane free.



Courtesy A. P. I.

Fig. 4—Relation between permissible Reid vapor pressure and atmospheric temperature + + + + + + + +

* W. C. Bauer, "Vapor Locking Tendencies of Automobile Fuel Systems," S.A.E. Summer Meeting, 1930.

† "The Meaning of the Gasoline Distillation Curve," by Graham Edgar, J. B. Hill and T. A. Boyd

** "Automobile Fuel Line Temperatures and Vapor Lock," by Oscar C. Bridgeman.

Propane, as is well known, is one of the light hydrocarbons and is a form of fixed gas found in rather large proportions in natural gas and, to some extent, in crudes. However, even if no propane is found initially, it will be generated in distillation, particularly in the cracking processes when the heavy hydrocarbons are broken down. The difficulty of eliminating propane may be gaged from the fact that it boils at atmospheric pressure at minus 47.4 deg. F. So far as we can learn it is good practice to hold propane content below one half of one per cent, but even this impresses an additional vapor pressure of 1.1 lb. per sq. in. at 100 deg. F., which is at least 10 per cent of the total vapor pressure.

It is sometimes good to look at the other fellow's problem. Here is what the refiner is up against. First, he has available an abundance of volatile gasoline with features that are highly desirable from the engine designer's standpoint. Yet, because of high fuel line temperatures he is forced to depress volatility and hold it between the two very narrow limits mentioned earlier. Consequently, wherever vapor locking is serious, volatility has to be reduced only to be followed by a serious sacrifice in starting ability. At this point the refiner runs into trouble with the consumer. And in many cases, notably in fleet operation, consumers have switched from one make of gasoline to another on the premise that the gasoline is at fault.

At present then, the refiner is constrained to work within a very limited range. For the most part, limiting fuel line temperatures are based upon Bridgeman's work and the specifications for gasolines marketed in 1931 will be designed from these. This means that many automobiles, old and new, which are above average conditions will vapor-lock this year.

An example of fuel specifications control showing the practice of the Atlantic Refining Co., Philadelphia, Pa., is found in Fig. 2. The upper curve shows the range in air temperature for Philadelphia excluding unusual variation; the lower curve shows the maximum Reid vapor pressure. The refinery follows this curve as closely as possible with a minimum number of changes in specifications.

Following the suggestion that the designer is interested only in Reid vapor pressure and the 10 per cent evaporated point, we have shown in Table 1 the pertinent data abstracted from the last Bureau of Mines Motor Gasoline Survey, which represented fuels collected in the summer of 1930. Interpolating from Fig. 1 for the relation between Reid vapor pressure and vapor locking temperature at sea level, we have built up the three columns under the heading "Vapor Locking Temperature." These give roughly the vapor locking temperature corresponding to the maximum, minimum, and average Reid vapor pressures. In all probability, vapor locking temperatures last summer were even lower because the gasolines were weathered considerably between the source of supply and the laboratory.

Vapor lock assumes serious proportions in the spring and fall due to erratic temperature changes in the transitionary period from winter to spring and fall to winter. Despite precautions taken by the refiners, a certain amount of winter gasoline having a higher Reid vapor pressure will continue to be sold into the spring in localities where the turnover is small. But, it must not be inferred that vapor lock occurs only during this period. It prevails in many sections most of the year and occurs on some cars during winter months, since the under-the-hood temperature is about the same in winter as it is in warmer weather. Moreover, vapor lock occurs during hot spells even with summer gasoline having a relatively low Reid vapor pressure.

In the light of the foregoing, what can the designer do about vapor lock? The consensus is that if he accepts the problem and the desirability of controlling it, he can overcome it effectively without radical changes in mechanical design and without appreciable added cost. The wide gap between fuel line temperatures of the best and worst cars with respect to vapor lock, as reported by Bridgeman, is simply amazing. It is pictured graphically in Fig. 3, which shows the temperature gradients for the fuel line using the minimum and maximum temperatures

Table 1

Summary of Temperature Increments

Competitive Price Gasoline	Reid Vapor Pressure lb. per sq. in. 1 Max.	2 Min.	3 Aver.	Vapor Locking Temp. Deg. F. For 1	For 2	For 3	10% Evaporated Deg. F. Max.	Min.	Aver.
Boston	8.5	6.3	7.3	129	147	139	153	128	139
New York	7.7	6.0	6.9	135	150	142	152	137	142
Washington	9.2	5.8	7.1	123	152	140	159	123	144
Pittsburgh	9.4	5.8	8.0	122	152	132	158	131	142
Cleveland	9.4	5.3	7.3	122	156	139	161	125	144
Atlanta	8.8	6.4	7.4	128	146	138	152	121	138
Chicago	9.5	6.6	8.1	123	145	132	158	125	139
New Orleans	9.9	5.4	7.3	120	156	139	160	122	142
St. Louis	8.6	6.3	7.0	129	146	140	156	132	144
Minneapolis-St. Paul	9.0	6.1	7.1	125	150	140	157	122	144
Omaha	8.7	4.4	6.8	128	170	143	158	131	147
Tulsa	7.5	5.9	6.9	137	151	141	163	135	148
Dallas	7.8	5.3	6.5	134	157	145	162	133	148
Denver	7.6	5.7	6.5	136	154	145	145	133	138
El Paso	6.7	5.1	6.0	144	161	150	156	132	148
Salt Lake City	7.5	6.4	7.1	136	146	140	145	126	137
Seattle	8.8	6.9	7.8	128	141	134	155	127	140
Los Angeles	9.1	6.4	7.3	124	146	139	162	124	141
San Francisco	8.7	6.5	7.8	128	145	134	160	115	141

Premium Price Motor Fuels	Reid Vapor Pressure lb. per sq. in. 1 Max.	2 Min.	3 Aver.	Vapor Locking Temp. Deg. F. For 1	For 2	For 3	10% Evaporated Deg. F. Max.	Min.	Aver.
Boston	7.8	6.2	6.9	134	147	141	151	136	141
New York	8.1	6.3	7.2	132	147	138	153	129	140
Washington	8.0	5.7	6.9	133	155	141	161	130	144
Pittsburgh	7.7	6.5	7.1	135	145	140	157	138	145
Cleveland	9.1	8.3	8.6	124	130	129	142	128	133
Atlanta	7.2	5.3	6.4	138	157	146	163	138	147
Chicago	10.0	6.4	8.0	119	146	132	155	127	143
New Orleans	8.3	5.9	7.0	130	151	140	156	135	141
St. Louis	8.0	5.3	6.6	132	157	145	154	139	145
Minneapolis-St. Paul	8.2	6.2	6.9	131	148	141	146	131	142
Omaha	9.0	6.7	7.9	126	144	133	149	118	133
Tulsa	8.7	5.8	7.0	128	152	140	149	130	140
Dallas	..	..	..	...	...	...	...	...	...
Denver	8.3	7.2	7.8	130	138	134	132	118	125
El Paso	6.4	4.1	5.4	147	172	158	163	151	154
Salt Lake City	7.0	5.7	6.3	140	155	147	152	132	138
Seattle	7.8	6.1	7.2	134	150	138	148	133	140
Los Angeles	6.5	6.4	6.5	145	146	145	145	137	141
San Francisco	8.2	6.2	7.0	131	148	140	146	130	139

Vapor pressure, 10 per cent point, and vapor lock temperature for fuels reported in the Bureau of Mines Twenty-second Semi-annual Survey. Vapor lock temperature estimated from Bridgeman's curves + + + + + + + + +

reported. Note the steep gradient through the fuel pump, and that of the main fuel line from the tank to the fuel pump inlet. The effect of design is striking enough considering the difference of over 60 deg. between the fuel pump inlet temperatures of the best and worst examples.

Another way of showing this condition is found in Fig. 4, taken from Bridgeman's last paper. What a wide spread in Reid vapor pressure is required to satisfy vapor locking conditions of the best and worst cars tested! For example, at idling a gasoline of 9 lb. per sq. in. vapor pressure will vapor lock at an atmospheric temperature of about 54 deg. F. on the worst car, whereas the best car will not vapor lock until a temperature of 115 deg. F. has been attained. It is quite evident that the refiner is absolutely at a loss to satisfy requirements such as these.

According to prominent investigators in this field, the following design factors should be considered if vapor lock is to be controlled:

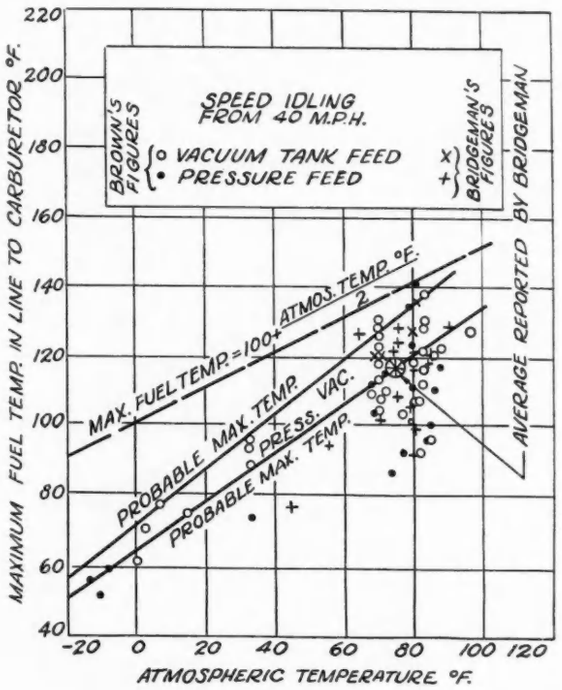

MAXIMUM FUEL TEMP. IN LINE TO CARBURETOR °F.
ATMOSPHERIC TEMPERATURE °F.
SPEED IDLING FROM 40 M.P.H.
BROWN'S FIGURES
VACUUM TANK FEED
PRESSURE FEED
BRIDGEMAN'S FIGURES
MAX. FUEL TEMP. = 100 + ATMOS. TEMP. °F.
PROBABLE MAX. TEMP. PRESS. VAC.
PROBABLE MAX. TEMP.
AVERAGE REPORTED BY BRIDGEMAN

Fig. 5—Taken from Dr. G. G. Brown's (Univ. of Michigan) discussion of O. C. Bridgeman's paper at the A.P.I. meeting April 15, Bridgeman's figures are taken from Table 2 and superimposed on Brown's figures, which were published last year. Note that Bridgeman's average falls exactly on line of probable maximum temperature based on Brown's work + + + + +

1. Location of fuel line. The high temperature rise in the main fuel line is usually due to close proximity of the exhaust manifold, exhaust pipe and muffler. A simple way of partially correcting this condition is to run the fuel line on the opposite side of the chassis away from the exhaust system. But the most effective method is to run the gas line on the outside of the frame so as to get an added cooling effect. An effective compromise is to insulate the fuel line.

Table 2

Summary of temperature increments above air temperature, according to Bridgeman + + +

	Average	Maximum	Minimum
A. Constant speed of 40 m.p.h.			
Fuel-tank outlet	18	29	8
Fuel-pump or vacuum-tank inlet.	29	49	10
Fuel-pump or vacuum-tank outlet	41	73	20
Carburetor inlet	42	60	26
B. Idling after 40 m.p.h. run			
Fuel-tank outlet	20	34	11
Fuel-pump or vacuum-tank inlet.	43	72	11
Fuel-pump or vacuum-tank outlet	59	90	38
Carburetor inlet	61	87	37
C. Climb up 6-mile mountain			
Fuel-tank outlet	26	36	19
Fuel-pump or vacuum-tank inlet.	43	53	26
Fuel-pump or vacuum-tank outlet	54	67	38
Carburetor inlet	56	73	37

2. Location of the fuel pump. On the average a rise of 20 to 25 deg. in temperature has been found between the inlet and outlet of the fuel pump and much of the vapor lock occurs here. Obviously the remedy is to place the pump where it will get the greatest cooling effect. At present about the only way to do this is to place the pump as low as possible and to subject it to the cooling effect of the fan air stream. It is also very important to insulate the pump against radiant and convected heat.

3. A cool carburetor is another essential. For one thing the exhaust pipe should be kept as far away as possible. In some cases an equally serious effect is induced by carrying the exhaust manifold structure too close to the carburetor flange.

4. Ventilation under the hood. The effect of radiator frontal area, louvers and radiator shutters also is vital consideration. For example, in some cases radiator shutters cut out so much of the radiator area that the under-the-hood temperatures in winter become very critical.

At one time or another the effect of putting the fuel lines under pressure has been discussed. Naturally, if the fuel lines are operated under an appreciable pressure from the main tank, the danger of vapor locking may be entirely eliminated up to the carburetor, since the vapor pressure as well as the 10 per cent point will be materially depressed. But it still could be serious in the carburetor under present conditions.

For the benefit of those who may wish to check their cars with the average car as reported by Bridgeman, we show in Table 2 a summary of temperature increments averaged from the results of all tests. "Average" temperatures reflect the largest production cars and will be used by refiners in setting specifications for 1931. To get comparable data, it is advisable to follow the procedure used in the Cooperative Fuel Research work. The points at which temperature data were obtained were as follows:

1. Vacuum tank systems—fuel tank outlets, vacuum tank outlets, carburetor inlets, carburetor bowls.

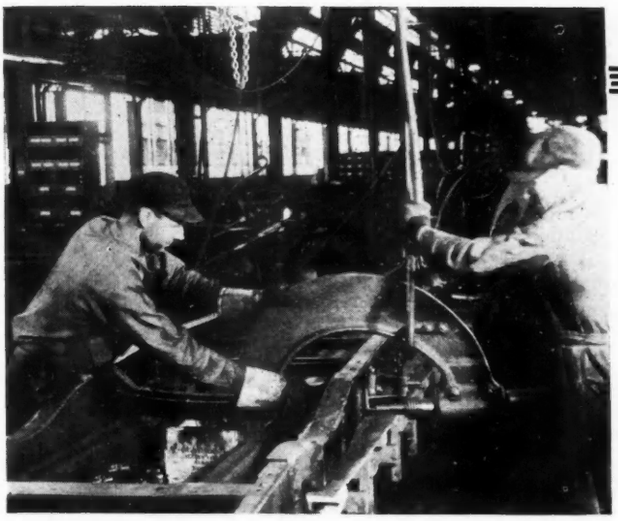
2. Fuel pump systems—fuel tank outlets, fuel pump inlets, fuel pump outlets, carburetor inlets, carburetor bowls.

3. Gravity feed systems—fuel tank outlets, sediment bowl outlets, carburetor inlets.

For temperature measurements, interchangeable resistance thermometers were made which fitted into specially constructed pipe fittings inserted in the

(*Turn to page* 813, *please*)

PRODUCTION LINES



Cold - yoke equipment now being used to rivet Dodge Brothers truck chassis on the assembly line insures an absolutely tight fit and greater rigidity +

Back from Milwaukee

It's just amazing how many people are thinking about tungsten and tantulum carbide tools. We have heard hardly anything else but for the last 2000 miles. More about this later.

Back Stroke Uplift

Some years ago, William Sellers, Philadelphia, built planers with tool holders which automatically lifted the tool on the back stroke. With the growing influence of tungsten carbide tools, the trailing tool holder of modern design is sure to be the next step. This action will be controlled hydraulically or by air. At least, that's the gossip we have from some pretty well informed individuals.

Tool Cribs on the Spot

Our good friend, J. W. Brussel (f. m. of Timken), is justly proud of his small tool stores and grinding set-up. Universally used tools, such as drills, reamers, milling cutters, hobs, chases, dies, etc., go to a central tool store. This department is centrally located and well equipped for proper grinding and conditioning. Other cribs are set up in each division under the superintendent's control. For instance, there is a grinding department exclusively for straight bevel and spiral bevel gear tools. Another in the worm wheel department handling worm gear hobs, cutters, etc. Tools are charged to each department. Each grinding department is equipped with racks with compartments for each department so that tools are properly segregated. Twice a day tools are picked up in each department and delivered to the proper tool grinding department. On the same trips, ground tools are delivered back to production departments.

Quick Work

One of those things that happen once in a lifetime happened at A. O. Smith on May 7. The occasion was a visit to the world-famous frame plant. And the frame line broke down. To our confused mind, it seems like a long time, a lot of blowing of sirens, and fixed attention at central control stations. But actually in just a few minutes the whole intricate mechanism was off again pounding out frames. The brief visit convinced us of the futility of describing the operation of this plant in cold print. So we won't do it.

Butane for B.H.P. Test

Bad news for public utilities. When a large number of engines, particularly heavy-duty engines, are brake tested on gas, the city gas supply is not always adequate or cheap enough in some communities. Out in the Middle West, some of the industrial engine builders are putting in butane plants to supplant city gas. Butane is a natural gas product stored in liquid form under moderate pressure, vaporized by passing through steam-heated coils.

What is Your Thought?

Gentlemen, may we have your ideas on this question? Should certain types of new machine tools be designed for maximum utilization of tungsten carbide tools? If so, how far should they go? Remember, they'll have to be heavier, more rigid, more rugged, with more power. How much more money is it worth?

Fast and Furious

There is just no end to the ingenuity of the production man. Just to prove that we don't know anything about fast metal cutting, one large automobile maker finishes the sides of drop-forged gear blanks by broaching. Gears are loaded into a continuous draw-bar and pulled between two parallel rows of broaches. The operation is fast and furious.

Change for Change's Sake

Some people will go round changing things. Iconoclasts, that's what they are. Met a man in Detroit who thinks that present tool forms aren't right. Don't be surprised to see some new tool forms evolved for the use of one of our biggest.—J. G.

MANUFACTURING MANAGEMENT METALLURGY

Seventy-two Enter in Largest Field

Grandstand straight-away of the Indianapolis Speedway, where the nineteenth 500-mile automobile classic will be run on May 30 + + + +

POPPET valves and rotary valves; two-cycle and four-cycle operation; four, six, eight and 16-cylinder engines and a Diesel all will have their chance at the nineteenth annual 500-mile race at Indianapolis on May 30. This is by far the largest field that has ever appeared for this race, not only from the standpoint of variety of design but also from the number of entrants, for over 70 cars will compete in the qualifying trials to see which will be among the lucky 40 to start on Memorial Day.

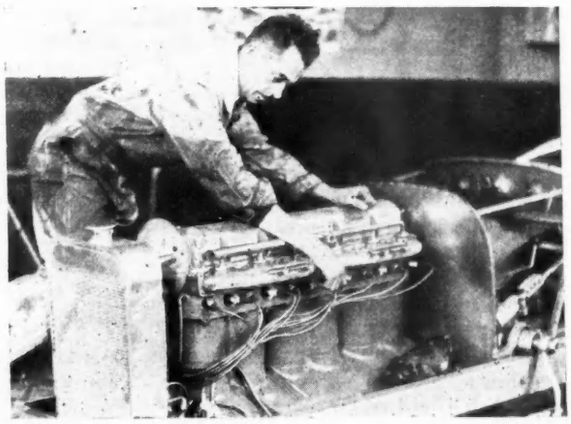
That the pace will be fast is clearly shown by some of the cars that are already at the Speedway and with last year's speed of 100.448 m.p.h., made by Billy Arnold in Harry Hartz's 150 cu. in front-drive Miller, to go by, most of the race drivers are quite confident that Pete De Paolo's record of 101.13 m.p.h., made in a 122 cu. in. supercharged Duesenberg in 1925, will soon be history,

Their guess seems safe enough, for the pace last year was slowed up for several laps because of the six-car crack-up on the north turn. Furthermore this year's cars will be undoubtedly faster because of the revision in rules permitting one carburetor for each pair of cylinders and the use of four valves per cylinder. Displacement limits remain at 366 cu. in. However, the more conservative drivers point out that the track was designed in 1911 for a speed of only 90 m.p.h.

The race will be of greater interest than usual, as three of the former record holders—Ralph De Palma, L. L. Corum and Pete De Paolo—each with a car of considerable interest, will do their best to set a new record.

Ralph made his record of 89.84 m.p.h. way back in 1915 with a four-cylinder Mercedes, which had a displacement of 274 cu. in. This record remained until 1922 when Jimmy Murphy crossed the finish line with his eight-cylinder 181 cu. in. job, having averaged 94.48 m.p.h. for the 500 miles. This record did not last so long, for two years later, L. L. Corum in a Duesenberg raised it to 98.23 m.p.h. The following year Pete De Paolo, also in a Duesie, established the present record of 101.13 m.p.h.

De Palma's car is powered with a Wehr rotary valve engine, built in Los Angeles. The engine is a straight-eight with a bore and stroke of 2.78 in. and 3.5 in. respectively. This gives a displacement of 172 cu. in. and with a car weight



F. W. Sparks will use a Curtiss K-6 airplane engine revamped to come within the displacement limit + + +

# of Indianapolis Racing History

Increased use of stock parts in this year's entries, and competition of famed drivers have generated unusual interest in the coming event

by W. K. Toboldt

Harry Hartz and "Bud" Winfield, carburetor engineer, looking over the 150 cu. in. front-drive Miller that Billy Arnold will drive + + + +

Russell Snowberger will use the same make of eight-cylinder passenger car engine that carried him to eighth place last year

of 1775 lb., gives a displacement-weight ratio of about 1.3. In regard to the rotary valve, this extends the entire length of the block and special means are provided for lubrication.

Corum's entry is practically stock, being a DV2 model Stutz with four valves per cylinder. This 322 cu. in. engine develops 160 hp. at 4000 r.p.m. and details were given some months ago in these pages.

A brand new Boyle valve Miller-engined job is Pete De Paolo's choice for the race. This is one of the most interesting cars entered and has a number of unusual features. First of all the eight-cylinder engine has a bore and stroke of $3\frac{1}{8}$ and $3\frac{3}{4}$ in. respectively, resulting in a displacement of 230 cu. in. and developing 200 hp. at 6000 r.p.m. The overhead valve construction follows conventional race car practice. The drive to the rear wheels and the spring suspension is of even greater interest.

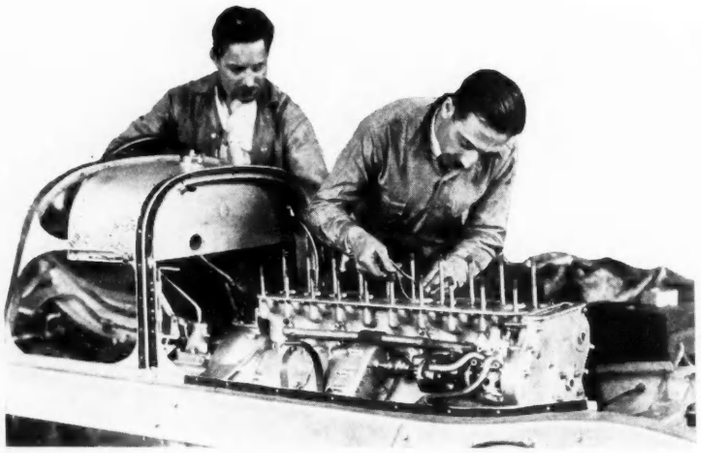
Double quarter-elliptic springs are used at both the front and rear. There are no universal joints between the transmission and the differential which is mounted directly on the rear cross-member. The axle shafts are exposed with universal joints placed at the wheel ends. In other words, while the car is rear driven, the construction resembles a front drive.

According to Pete De Paolo and Ralph Hepburn, who is also driving a car of this type, the car handles and rides very well, which is a big factor on the rough bricks of Indianapolis.

The 16-cylinder jobs are also of considerable interest. All together there are five cars with engines of 16 cylinders that are entered for the coming race. The most radical of these are the two cars entered by Cliff Durant, one of which is to be driven by Leon Duray, who qualified in 1928 at a speed of 122 m.p.h. These engines are of the two-cycle type and are said to operate on what is known as the Zoller Principle. The cylinders are arranged in two parallel banks of eight each with a common crankshaft. This construction necessitates one rigid and one articulated connecting rod which brings the pistons of corresponding cylinders of each bank to top center at approximately the same instant. The combustion chambers of corresponding cylinders of each bank are in common, so as to provide improved scavenging, which has proved so difficult when operating two-cycle engines at speed.

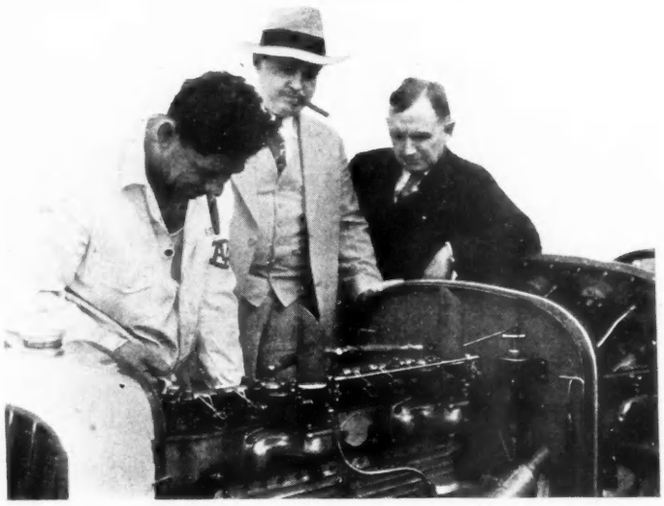
The Sampson Special, which finished in fourth place last year with Louie Meyer at the wheel, is again entered. In addition to detailed internal improvements, this car is undoubtedly faster as a result of better carburetion and manifolding and will also handle better because of changes in the steering.

Shorty Cantlon will drive a 16-cylinder Vee-16 Miller-engined job having valve mechanism of the usual race



Joe Caccia and John Lutness at work on the Jones and Maley Special. It has a Duesenberg engine with 146-in. displacement + + + + +

Below—John Russo is seen tuning up his Duesenberg Model A + +



car design. The spring suspension and drive to the rear wheels is similar to that used on the cars driven by De Paolo and Hepburn. It will be recalled that Cantlon wheeled a four-cylinder Miller into second place last year. S. C. Goldberg has entered a 16-cylinder car which, it is understood, is built up of two of the former eight-cylinder Cooper Specials with the engines placed side by side and geared together.

Having briefly described the 16-cylinder entries, let's take a look at the eights. Three of these have already been described and unfortunately space does not permit a detailed description of each of the 60 eight-cylinder cars, that will compete in the qualifying trials.

Naturally Harry Hartz's Miller, with Billy Arnold at the wheel, is looked on as being one of the most serious contenders for first place honors. This 150 cu. in. front-drive car has had a lot of detailed improvements since it led the field for 198 laps in last year's race. Perhaps the greatest of these is the use of four Winfield carburetors, which should give at least several miles per hour higher top speed. It will be recalled that Arnold's qualifying speed last year was 113.268 m.p.h., which gave him the pole position.

Louis Schneider, who placed third last year, has entered two Bowes Seal Fast Specials, both powered with Miller engines. Schneider's personal mount has a displacement of 150 cu. in., while the other car, to be driven by Tony Gullotta, has a displacement of 122 cu. in. Design of both of these rear-driven cars is conventional.

The remaining eights consist for the most part of Miller and Duesenberg racing cars and cars with revamped passenger car engines. Of this latter class, the most popular would seem to be the Model A Duesenberg, most of these having the original bore and stroke of 2.87 in. and 5 in. respectively, while a few have shortened the stroke to speed up the engine. Bill Cummings put one of these engines in fifth place last year, and the Alberti Special did well until it hit the wall in its forty-third lap.

Russel Snowberger, who finished in eighth place in the 1930 race, will again drive his passenger car engined job which has been improved by the use of four downdraft Winfield carburetors. The Bill Richards Special (last year's Romthe) and Ab. Jenkins' car are also using this same make of engine, it is understood.

The Elco Royale is another entry that may be classed as near stock. It has a 3.375 x 5-in. engine (357 cu. in.) and the wheelbase is 129 in.

There is only one car of six cylinders entered. This is the De Biase Special, powered with a Curtis K-6 airplane engine, with the internal dimensions altered to bring it within the 366 cu. in. displacement limits.

In the four-cylinder class there are nine entries, including the Cummins Diesel, which has been previously described in *Automotive Industries*. According to Dick Woods, his 155 cu. in. Mercedes is the one that won the French Grand Prix in 1914. Naturally it has been considerably altered since that date.

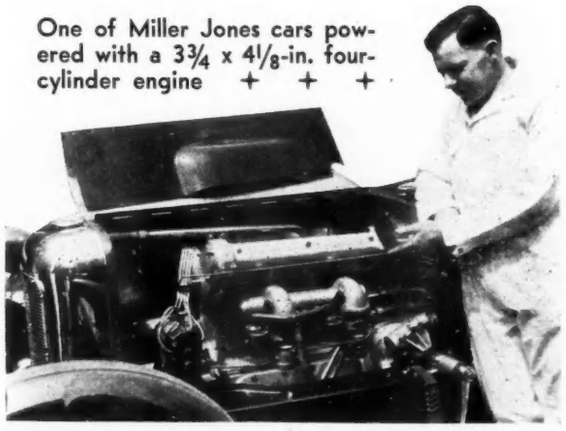
With a front drive winning last year's race, it is only natural that there is considerable interest in that type of construction, and that it has a distinct advantage on the Indianapolis track was clearly indicated by the way Billy Arnold was able to drive right through the oily spots of the track, while the rear drivers had to either slacken speed or try to find portions of the track that were not so slippery. Seven front drives are found in the entry list.

Taking the list as a whole, it is interesting to note the increased use of stock parts; this applies not only to engines but such units as axles, both front and rear, differentials, transmissions, clutches, etc. Undoubtedly, Russell Snowberger and his Russell Eight have had a big influence on race drivers and race car design. Last year Snowberger placed eighth at Indianapolis and

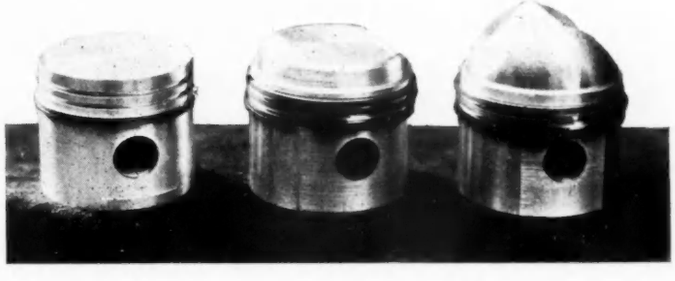
NAME OF CAR OR ENTRANT	Driver	Engine Make	No. of Cylinder Bore and Stroke	Displacement	Camshaft Location	Valve Location	No. of Valves Per. Cyl.
Stutz Bearcat	L. L. Corum	Stutz	8–3 3/16x4 1/2	322 cu. in.	Overhead	OH	4
Bill Richards Special	L. Johnson	Passenger Car	8–3 1/2x4 3/8	337 cu. in.	Crankcase	L-Head	2
Sampson Special	L. Meyer	Sampson	16–2 5/16x3	201 cu. in.	Overhead	OH	2
Miller-Wehr Special	R. De Palma	Wehr	8–2.78x3.5	172 cu. in.		Rotary	Valve
Marr Special		Passenger Car	8–2.87x4.5	234 cu. in.	Crankcase	L-Head	..
Bowes Seal Fast Special	L. Schneider	Miller	8–2 5/16x3 1/2	151.5 cu. in.	Overhead	OH	2
Bowes Seal Fast Special	T. Gullotta	Miller	8–2.35x3.5	122 cu. in.	Overhead	OH	2
P. Shafer	P. Shafer	Passenger Car	8–3 1/16x4 3/8	272 cu. in.	Crankcase	OH	2
B & N Special	Wm. Denver	Duesenberg	8–2 7/8x5	260 cu. in.	Overhead	OH	2
Milton Jones		Miller	4–3 3/4x4 1/8	183 cu. in.	Overhead	OH	..
Milton Jones		Miller	4–3 3/4x4 1/8	183 cu. in.	Overhead	OH	..
Boyle Valve Special	P. De Paolo	Miller	8–3 1/16x3 3/4	230 cu. in.	Overhead	OH	2
Ralph Hepburn	R. Hepburn	Miller	8–3 1/16x3 3/4	230 cu. in.	Overhead	OH	2
*Coleman Special	Lou. Moore	Miller	8–3 3/4x4 1/8	366 cu. in.	Overhead	OH	2
Jones and Maley Special	J. Caccia	Duesenberg	8–2.6x3 27/64	146 cu. in.	Overhead	OH	2
Buckeye Special	E. Triplett	Buckeye Spec.	8–2.79x3 5/32	154 cu. in.	Overhead	OH	2
Buehrig Special	Larson	Duesenberg	8–2.69x4.18	190 cu. in.	Overhead	OH	4
Russell Eight	R. Snowberger	Passenger Car	8–3.5x4.375	337 cu. in.	Crankcase	L-Head	2
McCarthy and Hauser		Duesenberg	8–2.5x4.18	162 cu. in.	Overhead	OH	4
Trexler Special	M. Trexler	Passenger Car	8–3.25x4.5	298 cu. in.	Crankcase	OH	2
Cummins Special (Diesel)	D. Evans	Cummins Diesel	4	361 cu. in.			3
Garry Miller Special	W. (Shorty) Cantlon	Miller	16	300 cu. in.	Overhead	OH	4
*Empire State Special	W. Cummings	Miller	8–2 5/16x3	100 cu. in.	Overhead	OH	2
Empire State Special			8				..
*Miller-Hartz Special	Billy Arnold	Miller	8–2.613x3.5	150.5 cu. in.	Overhead	OH	2
Harry Hartz		Duesenberg	8–2.87x4.6	236 cu. in.	Overhead	OH	2
Cliff Durant	Leon Duray		16–2 7/16x3 1/4	242 cu. in.	2 cycle		..
Cliff Durant			16–2 7/16x3 1/4	242 cu. in.	2 cycle		..
*F. Brisko	F. Brisko		8				..
W. S. White	B. Karnatz		4	183 cu. in.			..
Hunt Special	Ab. Jenkins	Passenger Car	8–3.5x4.375	337 cu. in.	Crankcase	L-Head	2
Duesenberg	M. Marion	Duesenberg	8	260 cu. in.	Overhead	OH	..
Elco Royale Special		Passenger Car	8–3.375x5	357 cu. in.	Crankcase	L-Head	2
G. N. H. Special	G. N. Howie		8				..
Jadson Special	M. Stevens	Miller	8		Overhead		..
G. H. Henry	J. Russo	Duesenberg	8–2.87x5	260 cu. in.	Overhead	OH	2
Miller Special	R. Decker	Miller	8–2.40x3.5	124 cu. in.	Overhead	OH	2
De Biase Special	F. W. Sparks	Curtis	6–4 1/2x		Overhead	OH	2
*C. E. Ricketts	Speed Gardner	Miller	8–2.34x3.5	122 cu. in.	Overhead	OH	2
Morton & Brett Special			8–3x4	226 cu. in.	Overhead	OH	2
Butcher Bros. Special	H. Butcher		8	272 cu. in.			..
Model A Ford Special	C. Moran, Jr.		8–3.87x4.25	200 cu. in.			..
R. W. Painter			8				..
Pedrick Piston Ring Special	F. Farmer	Miller	8–2 5/16x3	100 cu. in.	Overhead	OH	2
Fronty Special	E. Hausteine		4–3 3/4x4	176 cu. in.	Overhead	OH	2
Finneran Special	J. Thomas		8				..
Duesenberg Special	B. Brandfor		8				..
F. E. Clemons			8				..
F. E. Clemons			8				..
Miller Special	J. Patterson		8				..
Duesenberg Special		Duesenberg	8–2 7/8x4 1/2	232 cu. in.	Overhead	OH	2
Duesenberg Special		Duesenberg	8–2.87x5	263 cu. in.	Overhead	OH	2
R. S. Woods		Mercedes	4–3 5/16x4 7/8	155 cu. in.	Overhead	OH	4
Woods Special		Passenger Car	8–3 3/8x4 1/2	322 cu. in.	Overhead	OH	2
Wingerter Special	G. Wingerter	Duesenberg	8–2.89x5	263 cu. in.	Overhead	OH	2
Wm. Yahr	S. Ross		4				..
Burbach & Classon	E. Burbach		8				..
Midway Motor Service	W. J. Zale		8				..
Duesenberg Special	M. Fox		8				..
A. S. Duesenberg		Duesenberg	8–2.75x3.16	150 cu. in.	Overhead	OH	2
J. H. Wade			8				..
J. H. Wade			4				..
J. H. Wade			4				..
Duesenberg Special		Duesenberg	8–2.895x4.625	242 cu. in.	Overhead	OH	2
Duesenberg Special	P. Pardee		8				..
Miller S. L. Special		Miller	8–2.44x3.5	124 cu. in.	Overhead	OH	2
Henry Maley	Deacon Litz		8				..
*S. C. Goldberg			8–2.31x3	100 cu. in.	Overhead	OH	2
*S. C. Goldberg			16–2.31x3	200 cu. in	Overhead	OH	2
Schofield-Curlett Dial Spec.	Walt May						..
C. C. Smith Special							..
Alberti Special	Al. Aspen	Duesenberg	8–2.87x5	260 cu. in.	Overhead	OH	2
Duesenberg Special		Duesenberg	8		Overhead	OH	..

* Denotes front drive.

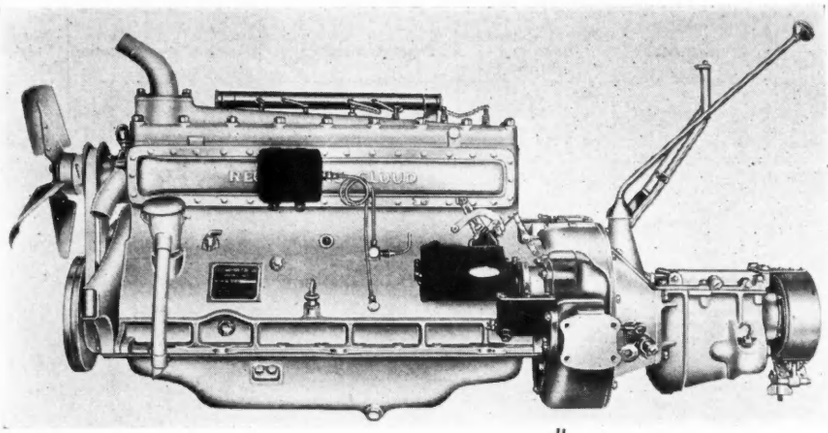
One of Miller Jones cars powered with a 3¾ x 4⅛-in. four-cylinder engine + + +



ranked fourth in the A.A.A. list of drivers. His car was built principally of stock parts and is said to cost in the neighborhood of $1,500. Repairs for the season totaled less than $5, it is said. Comparing these figures with a strictly racing car costing $10,000, $15,000 or $20,000, and with a single connecting rod priced at $75, it is only natural that many race drivers are turning to stock parts.



At the right are the pistons used in Meyers car for the last three years. Better flame travel is claimed for the one on the right



The eight-cylinder engine on the 8-21 model has a four-point suspension with rubber insulation and carries Nelson Bohnalite Invar strut pistons + +

New Reo Flying Cloud Close to $1,000 Class With a "Six" and an "Eight"

Herringbone silent second transmission, large piston displacement, adjustable cross seat and steering column, hydraulic shock absorbers and chrome-plated exterior hardware are outstanding features of the new Reos

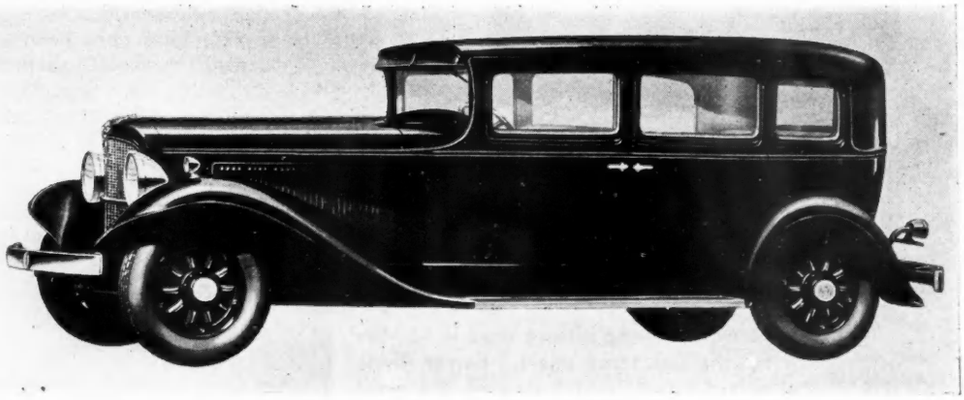
TWO new Flying Cloud models, a six and an eight, mark the reentry of the Reo Motor Car Co. into the just-over-$1,000 price class. Initially the new cars are offered in only one body style, a five-passenger four-door sedan, listing at $1,295 for the six and $1,395 for the eight.

They are large cars for this price field, with a wheelbase of 121 in., but with ample power to insure good performance. Externally they are distinguished particularly by a sharp V-shaped radiator and a fender design similar to that on the Royale models, with the radiator shell lacquered to match the body color and chrome-plated applied trim moldings and name plate. The relatively high belt line of the body, together with the long hood and the new radiator, gives a pleasing "balance" to the general appearance.

Mechanically, the two cars, the 6-21 and the 8-21, except for the powerplant and a number of minor details, are virtually alike and consist entirely of proved

The High Belt Line Helps to Make an Attractive Body

Side view of the new Reo Flying Cloud, offered both as a six and an eight, with prices of $1,295 and $1,395. Note the radiator shell and front fenders. Wheelbase is 121 in.



units. The six-cylinder engine is virtually the same as that used in the larger Flying Cloud Six, and the eight has been developed from an existing design. It is said to peak at 90 hp. at 3300 r.p.m.

Some of the features which stand out particularly considering the price-class include: Reo herringbone silent second transmission; large piston displacement for reliability and performance; six-inch section tires on 17 in. base wheels; large 119 amp. hr. capacity battery, front springs over 37 in. and rear springs over 56 in. long; cam and lever steering gear; 21 gal. gas tank; chrome-plated radiator grilles as standard equipment; chrome-plated head and fender lamps; 10 in. spring cushioned clutch; 58 in. front and 59 in. rear tread; clock type speedometer.

In addition to these items, standard equipment further includes adjustable cross seat, adjustable steering column, two-way hydraulic shock absorbers, large three-spoke steering wheel, with all controls on the dash, including those for lights, semi-automatic spark advance, choke, throttle, manifold heat control, and starter; hydrostatic fuel gage and temperature indicator on the dash; combination coil and ignition lock; rear-view mirror, automatic wiper; looped assist cords, robe rails, draw shades, combination rear-traffic signal, two ash trays, two cowl ventilators with gear shift lever ball type control handles; Mono-control swinging straight windshield; single central concealed type combination hood latch and handle, locking the hood against the dash and the radiator shell; two pockets in the rear doors; radiator filler cap under the hood to clean up the radiator shell; Tryon self-adjusting metal shackles, and exterior hardware is chrome-plated.

Four wood wheels are standard with wire wheels and fender wells at extra cost. The floor in the rear compartment has been sunk on either side of the propeller shaft clearance tunnel, which, together with a recess at the bottom of the front cross seat back, provides the car with an unusual amount of leg room, and also permits a low seat height in the rear for ample head room and low center of gravity. Roofs are of French type of construction, having metal roof side and rear quarter upper panels, welded together. A cadet type of external sun visor is used. Running boards are covered with corrugated rubber mats and are bound with aluminum moldings.

Four-point suspension is used for both the six and the eight-cylinder powerplant, with rubber insulation at all four points on the eight, and at the rear on the six. The eight-cylinder powerplant is of the five-bearing L-head type with chrome nickel iron blocks as on other Reo passenger cars and Speedwagons. It carries Nelson Bohnalite Invar strut pistons, an AC fuel pump, four rings per piston, Lanchester torsional vibration damper, 30 deg. intake valve seats, Handy oil filter, thermostatic water circulation control, and metric spark plugs. Detailed specifications are shown in tabular form.

In addition to the five-passenger sedan, a rumble seat coupe will be put into production shortly.

The New Reo Flying Clouds in Detail

	"Six"	"Eight"
Wheelbase	121	121
Tires	6.00/18	6.00/17
Engine	Own	Own
Bore and stroke (in.)	3⅜ x 5	3 x 4¾
Taxable horsepower	27.34	28.8
Displacement (cu. in.)	268.4	268.6
Maximum brake hp. at r.p.m.	85-3200	90-3300
Compression ratio	5.3	5.37
Valve arrangement	L	L
Camshaft drive make	Morse	Link-Belt
Piston material	Aluminum	Aluminum-steel strut
Number main bearings	7	5
Oil cleaner make	Handy	Handy
Engine temperature control		Thermostat
Carburetor make	Schebler	Schebler
Fuel feed make	VanSicklen	VanSicklen
Ignition make	Delco-Remy	Delco-Remy
Generator-starter make	Delco-Remy	Delco-Remy
Battery make	Willard	Willard
Engine mounting	Rubber front-rear	Rubber front-rear
Clutch make	Long	Long 9 ABM
Gearset make	Own three-speed in unit with engine on both models	
Universals make	Detroit	Spicer
Rear axle make	Own semi-float	Own semi-float
Service brakes	Internal four-wheel hydraulic on both models	
Hand brakes	External transmission on both models	
Steering gear make	Ross	Ross
Steering gear type	Cam and lever	Cam and lever
Shackles make	Tryon	Tryon
Springs	Front, semi-elliptic, 37¼ in.	Front, semi-elliptic, 37¼ in.
	Rear, semi-elliptic, 55¾ in.	Rear, semi-elliptic, 56⅛ in.
Chassis lubrication make	Zerk	Zerk

Tuning of Fan to Engine Noise Results in Quieter Operation

A NEW type of fan for automotive cooling systems has recently been introduced by the Automotive Fan and Bearing Co. of Jackson, for whom this unit was developed by its chief engineer, A. D. Gardner. It is at present used on a number of cars in production, and has been released for several others.

The fan has been developed as a means of combating the objection to fan noises which have become more noticeable with the general tendency toward silencing the powerplant and other chassis units. In attempting to develop quieter fans the designer has been faced with the problem of being required to deliver constantly increasing amounts of air through the radiator core, what with the adoption of larger engines, smaller and thicker cores, etc. The two—increasing air requirements, and less noise, of course, are contradictory, other things being equal.

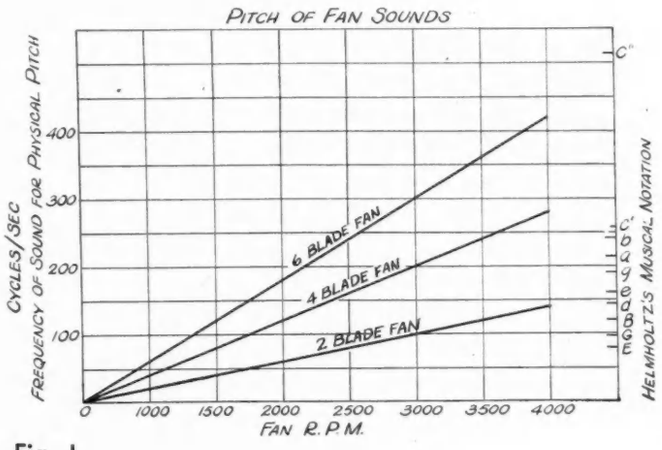


Fig. 1

Musical tone characteristics of two, four and six-bladed fans at different engine speeds. These are of course for the fundamental note, the harmonics not being shown + + + + +

On some cars it has been found practically impossible to eliminate fan noise with conventional types of fans; some installations, for example, showing practically no difference in volume or intensity of fan noise between an inherently extremely "noisy" fan and a "quiet" fan of normal designs. Mr. Gardner reached the conclusion therefore that the fan and the parts surrounding it seemed to comprise an acoustical combination which was but little affected by changing from one fan to another of the same general type.

Mr. Gardner continues to tell the story of the development of the new unit: "Since an appreciable reduction in fan noise appeared unlikely under the conditions, an attempt was made to alter the noise characteristics of the fan so as to blend or merge the sound with powerplant noises at the speeds and under the operating conditions where the noise had been most pronounced. This was accomplished finally by changing the angular spacing of the fan blades about the axis of rotation.

"For a two-bladed fan, the frequency of the sound given forth is $2 \times \frac{\text{fan r.p.m.}}{60}$ cycles per second. For a four-blade fan, the fundamental frequency is twice as great, or $4 \times \frac{\text{fan r.p.m.}}{60}$ cycles per second. For a six-bladed fan it would be three times the first

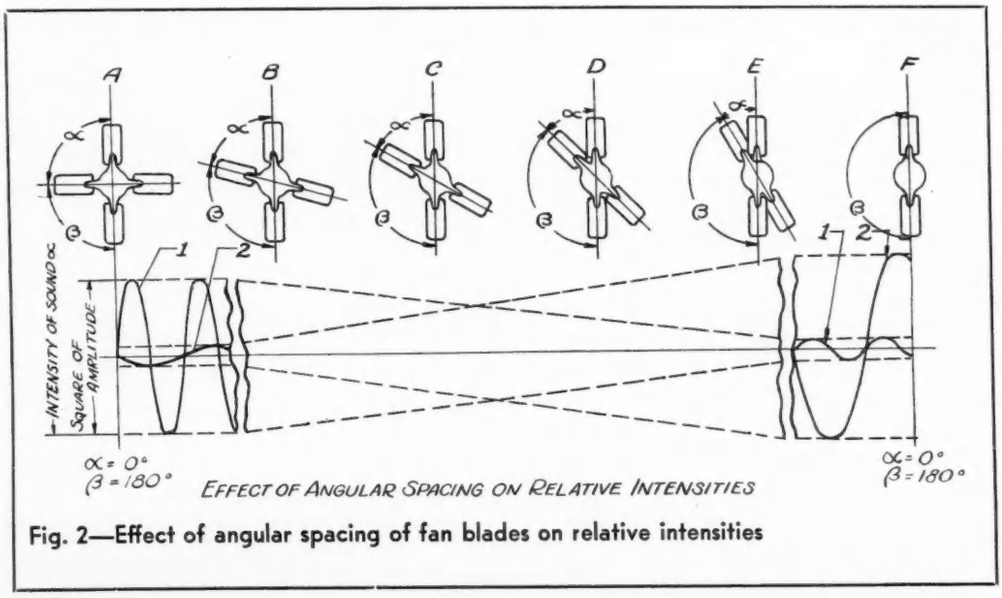


Fig. 2—Effect of angular spacing of fan blades on relative intensities

The fan and surrounding parts comprise an acoustical combination little affected by changing from one fan to another of the same general type + + + +

Altering the noise characteristics to blend with those of the powerplant by changing the angular spacing of the fan blades was the solution + + + + + +

by
Athel F.
Denham

value, the ratio of frequencies, of course, being that of the number of blades for a given speed or in the ratio of the number of revolutions per minute for a given number of blades."

Fig. 1 shows the relationships established between frequency of sound and fan r.p.m. for different fan types, together with the musical notes corresponding to the frequencies. In this figure, for instance, a two-bladed fan gives forth the tone *B* (in the bass clef) at about 3600 r.p.m. A six-bladed fan gives the tone *c'* in the middle register at about 2560 r.p.m.

Fig. 2 is a diagrammatic layout showing what occurs when the fundamental frequencies of the fan are changed by altering the angular blade locations. At *A* in this figure, with a blade spacing of 90 deg., the sound wave of the four-blade frequency is represented by the large sine wave (1), and the two-blade sound wave by (2). As the angle (α) between the blades is decreased from 90 deg. at *A*, through the various stages, *B*, *C*, *D* and *E*, the intensity of the four-blade sound, as presented in this drawing by the amplitude of the curve (1), gradually decreases and the intensity of the two-blade sound increases. It is not claimed that there is a straight line relationship, the dotted lines merely indicating the nature rather than the character of the change, in amplitude. At *F*, of course, the fundamental of the two-bladed fan would have to predominate.

Experiments show, according to the manufacturers, that for roughly the positions *A*, *B* and *C*, the higher frequency four-blade sound is dominant, while for the three others the lower pitched two-blade sound becomes dominant. Referring back to Fig. 1, it will be noted of course that the four-blade sound in reality is an octave of the two-blade sound, and the six-blade type for the double octave.

It remained necessary now only to determine by observation and measurement what the noise characteristics were for a given powerplant and then adapt the fan to that powerplant by "tuning" it to blend with existing noises.

Curiously enough the quantity of air delivered by the fan with an assymetrical blade-setting of this kind seems to be actually greater than for a symmetrical fan of the same type. The manufacturers state that the quantity of air delivered by the fan in most cases increases in varying degree as the angle is changed from 90 deg. to 60 or 70 deg., after which it drops off rather rapidly. Fig. 3, curve 4, shows a typical four-bladed fan, curve three representing the horsepower requirements. It will be noted also that curves 3 and 4, horsepower, and air flow, follow each other very closely over a quite wide range of values of angle between the blades. The manufacturers state, however, if the blades are spaced too close together, this relationship is apparently upset.

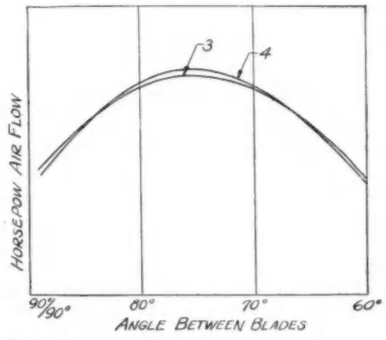


Fig. 3

Effect of angular spacing on horsepower requirements and air flow delivery + + +

No explanation is being offered by the manufacturers for the increase in air flow with the change in angular blade setting. Evidently, though, the gain due to the wider spacing of two of the four blades must be more than sufficient up to certain limits to offset the loss caused by the closer setting for the other angle. Fig. 4 shows a number of typical fans of the new design.

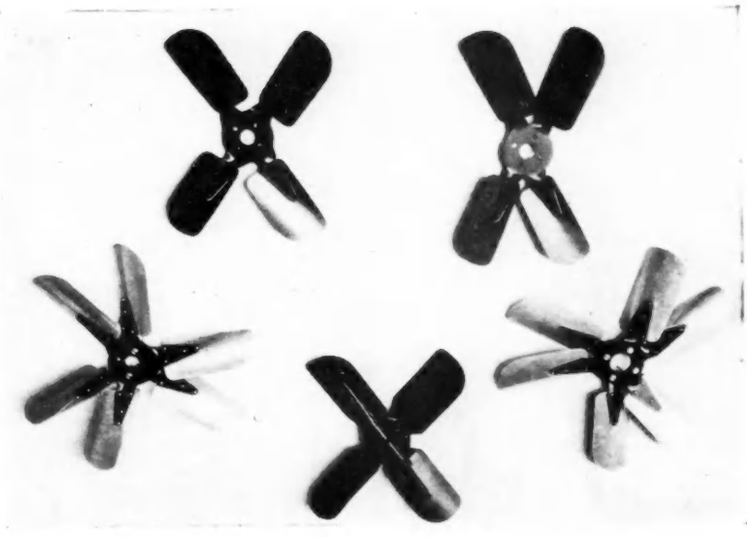
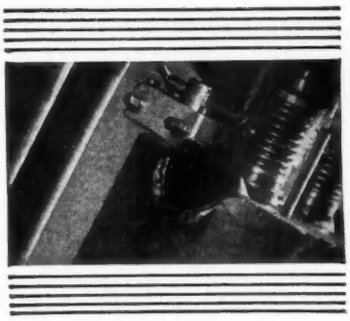


Fig. 4

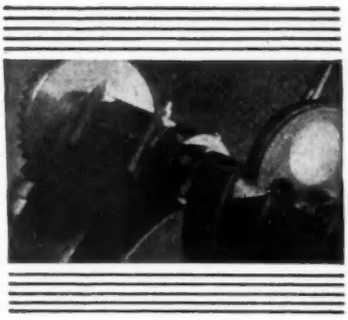
Typical assymetric fans of the new type produced by Automotive Fan and Bearing Co. Upper left—70 deg. spacing. Upper right—50 deg. Lower left—35-85 deg. Lower right—40-80 deg. Center—75 deg. spacing

Automotive Oddities—By Pete Keenan

COMIC CARTOON ON THE AUTOMOBILE AND AIRPLANE PRINTED MORE THAN 100 YEARS AGO IN THE EDINBURGH REVIEW.
Pete Keenan
NEBRASKA LEGISLATORS AIM TO TAX GASOLINE 12¢ A GAL.
GOS
A LUNCH ROOM CHEF IN BOSTON TIMES HIS EGGS BY A TRAFFIC LIGHT.
GO.
LOOK WHERE HE HAS THE ROCKETS! A YOUNG GERMAN NAMED RICHTER HAS INVENTED THIS ROCKET BIKE.
YOUNG STRIBLING IS THE AUTOMOTIVE FAN OF THE ATHLETIC WORLD He owns two High Powered cars, Motor Racing Boats and an Airplane.



NEWS OF THE INDUSTRY



Aero Leaders Form New Safety Group

Adopt Code Covering Wide Phases of Work

NEW YORK, May 18—Leaders of the aviation industry have formed an Aviation Safety Conference to further the work already accomplished by the industry in the lines of safety.

This conference was organized by the board of governors of the Aeronautical Chamber of Commerce of America, Inc. The board also approved a Safety Code, which has been in the preparation for more than a year, and covers nearly every phase of aviation activity.

Ford Offers Glass Option

DETROIT, May 18 — Ford Motor Co. is now offering new cars with the optional equipment of safety glass in all windows and doors at an extra charge of $15 for the coupe, de luxe sport coupe and convertible cabriolet, and $20 for the Tudor sedan, standard sedan, de luxe sedan, town sedan and Victoria models.

Safety glass windshields continue as standard equipment at no extra charge.

S.A.E. Program Set

NEW YORK, May 21 — The complete program of papers and events for the summer meeting of the Society of Automotive Engineers, to be held at White Sulphur Springs, June 14-19, was announced this week by the society, and appears on page 815 of this issue of *Automotive Industries*.

Gardner Holders to Meet in N. Y.

NEW YORK, May 19—Stockholders of Gardner Motor Co., Inc., will hold a special meeting here June 16, to vote on the action of the directors recommending the reduction in par value of the company's stock.

POLAND, the country, jumped into international prominence again on the 17th by temporarily becoming a country without an automobile . . . excessive taxes on private operation of automobiles caused owners to declare an embargo on their operation and Warsaw went motorless, except for a few municipally operated buses . . . on the 18th, all commercial traffic was suspended until midnight, beginning at seven in the morning . . . several hundred car owners are reported to have turned in their licenses rather than operate vehicles under the new rates . . . official protests were numerous . . . there's a nice job for John North Willys, ambassador to Poland, to straighten out * * * Sir William Morris, the Br. motor magnate, was honored with a D.C.L. by Oxford University last week . . . Sir William is interested in many humanitarian charities * * * the Association of Blacksmiths of the Province of Quebec has reported a large increase in the number of horses in the province during the years 1923-1929 * * * Continental Motors has just about completed its job of working out with the Holabird Quartermaster's Depot a modernization program for the old "Army B's" . . . the four-cylinder engines will be replaced with Continental sixes and pneumatic tires mounted on the wheels, etc., etc. * * * American Hammered Piston Ring had to ask Baltimore police for permission to run its plant 24 hr. on Sunday, due to a big climb in sales * * * the number of persons killed in automobile accidents in Paris showed a sharp decrease in the first two months of 1931, compared with the first two months of 1930 . . . maybe that can be traced to the fact that during that time most of the ancient wheezing cabs have been taken off the streets and replaced with new Citroens * * * visitors to the races at Indianapolis will have a chance to see some of the most famous racing cars of the past and present, at an exhibit to be staged at the Duesenberg factory . . . other cars than Duesenbergs will be on display * * * There were many fewer grade crossing fatalities in 1930 than in any year since 1922, according to D. H. Beatty, chairman of the Committee on Prevention of Highway Grade Crossing Accidents of the Safety Section of the American Railway Association . . . they ought to start a campaign to get motorists to repeat all that before crossing the tracks . . . that ought to cut accidents (barring lockjaw) down to a minimum * * * Atlantic City opened a testing lane for automobiles last week . . . the director of public safety of the village trundled through his car first, to serve as an example to the assembled multitudes . . . and the car failed to pass the standards for brakes and wheel alignment * * * employees of the Wright Aeronautical Corp. will present to Admiral Byrd, a sundial made in London.

THE NEWS TRAILER

M. E. A. Index Better in April

Service Parts Factor Shows Largest Gain

NEW YORK, May 20—The Motor & Equipment Association index for April showed a gain of 11 points over the figure for March. The tabulation shows:

	April	March	Change	April, 1930
Original Equipment	127	117	+10	175
Service Parts	127	110	+17	150
Accessories	66	65	+ 1	74
Service Equipment	118	115	+ 3	180
GRAND INDEX	124	113	+11	163
Jobbers' Sales	105	94	+11	119

Met. Section Elects

NEW YORK, May 21—The following officers were elected at the meeting of the Metropolitan Section, Society of Automotive Engineers, held last evening: E. H. Hamilton, New York University, chairman; J. F. Creamer, Wheels, Inc., vice-chairman; Charles Froesch, Fokker Aircraft Corp., vice-chairman for aeronautics; A. L. Beall, Vacuum Oil Co., secretary; and M. C. Horine, Mack Trucks, Inc., treasurer.

W. C. Durant Sells Building

NEW YORK, May 19—W. C. Durant has sold a factory building owned by him in Jersey City, N. J., to the Provost Realty Co., Inc. This building was the personal property of Mr. Durant, and did not belong to Durant Motors. The sale is said to be one of the biggest real estate deals in New Jersey this year.

Frederick A. Reimer

NEW YORK, May 19—Frederick Adams Reimer, president of the American Roadbuilders Association, died suddenly yesterday in East Orange, N. J., where he was conducting a road survey.

Estimated Stocks of Motor Vehicles Abroad at End of April 1931

WASHINGTON, May 18—Cabled reports of world stocks of automobiles received by the Automotive Division, Department of Commerce, covering the month ending April 30, 1931, show that the stock position abroad as revealed may in general be considered satisfactory in relation to the state of demand.

In a few markets, where the depression is especially acute, automobile stocks, although considerably below the levels of normal times, are high in view of the low level of sales. Stocks of American low-priced cars are reported as normal in 20 countries; seasonally high to high in 9, and seasonally low to low in 4. Stocks of American medium-priced cars were normal in 15 countries; seasonally high or high in 11, and low or seasonally low in 8.

High-priced American car stocks were normal in 15 markets; high or seasonally high in 5 and low or seasonably low in 11. Stocks of American light-capacity trucks were indicated as normal in 8 countries; high or seasonally high in 5 and low or seasonally low in 10. American heavy-capacity trucks were normal in 21 foreign markets; high in 7 and low or seasonally low in 4.

Stocks of European cars and trucks generally correspond in most markets to the condition of stocks of American automobiles. In France stocks of domestic cars were all reported as high, with stocks of medium-priced cars unusually high. Likewise in Germany stocks of domestic cars were high with stocks of domestic medium and high-priced cars reported unusually high. In general high-priced car stocks in Europe were from low to normal, whereas stocks of low-priced and medium-priced cars were in the normal to seasonally high group.

Stocks of American used cars were reported in the high class in 20 foreign countries, normal in 7 and low in 4. Of the 22 countries for which European used car stocks were reported, 18 were in the high category and 4 each in the normal and low groups. Tabular comparison follows:

	PASSENGER CARS				USED CARS				TRUCKS AND BUSES			
	Low Priced		Medium Priced		High Priced				Heavy Capacity		Light Capacity	
Country	U. S.	Other	U. S.	Other	U. S.	Other	U. S.	Other	U. S.	Other	U. S.	Other
Cuba	N	N	N	....	H	....	H	....	H	....	N	....
Porto Rico	N	....	N	....	L	....	....	....	....	....	....	....
Mexico	N	....	N	....	L	....	H	....	SL	....	N	....
Colombia	N	None	N	L	N	None	H	UL	N	....	N	None
Panama	N	....	H	....	H	....	N	....	N	....	N	....
Chile	N	N	N	N	H	N	H	....	N	N	N	N
Peru	All automotive stocks normal.											
Brazil	All automotive stocks high.											
Uruguay	N	H	N	L	L	None	L	L	UL	L	N	N
Denmark	N	N	H	H	N	None	UH	UH	N	N	SH	N
Finland	N	N	L	....	N	....	UH	....	UL	....	N	....
Sweden	SH	....	SH	....	N	.. .	SH	H	SH	....	N	....
Norway	SH	N	SH	SH	L	L	H	L	L	L	N	L
Belgium	SH	N	N	UL	N	L	L	SH	L	L	H	L
Netherlands	N	N	SH	N	SH	N	SH	N	N	N	N	N
France	SH	UH	L	SH	N	H	N	H	None	N	SH	SH
Germany	L	H	L	UH	N	UH	H	H	None	....	L	H
England	SH	SH	SH	SH	L	N	L	N	None	....	N	L
Portugal	H	N	L	L	L	L	H	H	L	L	H	N
Spain	N	L	N	L	L	L	L	L	L	L	N	N
Austria	N	N	N	N	N	H	H	H	None	H	N	H
Czechoslovakia	N	L	H	N	N	H	N	H	N	H	N	SH
Hungary	N	SH	H	SH	N	N	UH	UH	N	N	N	N
Greece	N	N	N	N	N	N	H	H	N	N	N	N
Switzerland	SL	N	SL	N	N	N	SH	SH	UL	L	L	N
Poland		SH	H	N	L	L	N	N	L	N	H	N
Rumania	SH	SH	N	N	UL	UL	N	SH	L	UL	N	L
Turkey	All automotive stocks unseasonably low.											
Egypt	N	N	SL	SL	N	L	H	H	L	L	N	L
Gold Coast	N	L	L	None	None	None	....	....	SL	None	SL	None
China	Stocks below normal. Exchange fluctuations prevent increased dealer stocks.											
Japan	N	N	SH	....	N	....	SH	....	H	....	N	....
N. E. Indies	L	....	N	N	L	L	H	....	....	....	N	L
British Malaya	H	N	N	N	....	....	H	H	N	N	N	N
Siam	N	N	N	N	None	None	N	N	H	N	H	N

Note: U-Unusually. S-Seasonally. N-Normal. H-High. L-Low.

All descriptive terms used in this report pertain to the stock situation in relation to the current condition of each market. "High" stocks means the supply is considered large in relation to the current state of demand although the same volume might be regarded as "normal" at a time when sales were more active. "Normal" is used almost synonymously with "adequate"—in other words when the volume on hand is sufficient to supply immediate requirements plus the estimated demand for 1-1½ months. It is believed this method of reporting is more suitable than to describe the volume of stocks in comparison with some arbitrarily determined period which might be regarded locally as normal.

German Engineers of VDI Celebrate

PHILADELPHIA, May 18—On May 12, the Verein deutscher Ingenieure (Association of German Engineers) could look back upon 75 years of successful activity. In the spring of 1856, twenty-three young and enthusiastic engineers met at the small town of Alexisbad in the Harz mountains and organized the Verein deutscher Ingenieure, whose object they specified to be "to coordinate the efforts of the best technical brains for the benefit of the industry of the country."

In celebrating its seventy-fifth anniversary the VDI in the first place remembered its founders, to whose vision and organizing ability it owes much of its success, and on May 12 a memorial was unveiled to their memory at Alexisbad, which shows a young engineer with his gaze fixed upon some distant object. He personifies the slogan coined by one of the founders—"Now to work."

In addition to this small commemorative celebration, this year's annual meeting, which will be held at Cologne, June 27-29, will take the form of an anniversary celebration. However, in view of the tradition of the VDI as a scientific body and of the present hard times, no extensive festivities are planned. Technical and scientific sessions will have the first place on the program, and the chief paper will deal with Radiation Problems, thus emphasizing the relation between the problems of engineering and those of modern physics. There will be eleven professional meetings and a large variety of topics will be discussed. One paper deals with Diesel Engines for Motor Trucks, and another with Light Metals and Transportation.

Raymond Meyers Killed

FORT WAYNE, IND., May 18—Raymond Meyers, Indianapolis race driver, was killed at Fort Wayne Speedway, when his car plunged over an embankment making a turn at high speed. The accident occurred during qualifying trials. Windy Jennings, of South Bend, was injured in the 25-mile feature race, when his car turned over and burst into flames. Ira Hall of Terre Haute captured first place in this event.

Hot Engine Spots Bother

Joseph Geschelin Discusses Vapor Lock Conditions

(Continued from page 800)

fuel feed line. Details of the thermometer and fittings are given by Bridgeman.*

Service is a moot question. Whether we like it or not, vapor lock still occurs on many cars. And a strong suspicion prevails that the service men out on the firing line do not know what it's all about and probably do not recognize vapor lock except in unusual cases. This has been substantiated by many reliable observers whom the writer interviewed. They have found many cases where typical vapor lock has been diagnosed as something else and treated by cleaning spark plugs or replacing them, cleaning distributor points and sometimes cleaning out the entire fuel line.

Why not tell the service organization something about the problem and some of the simple but effective means for correcting vapor lock in the field? For example, where the exhaust manifold is too close to the carburetor it can be readily insulated to eliminate a good deal of the radiant heat. In some cases a thick cork or asbestos gasket between the carburetor and intake manifold flange may serve to minimize the heating effect of an exhaust manifold.

On vacuum tank jobs some fallacious reasoning has been ably dispelled by Bauer. He found that where it is not possible to do much with the carburetor, a simple remedy is to move the vacuum tank a little closer to the engine. Obviously the reason for this is that additional heat will produce a weathering effect on the fuel in the tank, thereby reducing maximum vapor pressure. Incidentally this weathering effect seems to be one of the reasons why vapor lock was not quite so prevalent with vacuum tanks.

Another quick remedy which has been suggested is the simple expediment of increasing the idling speed to prevent complete stoppage of the engine. This might be very useful out on the road or where time does not permit mechanical changes in the fuel system.

Viewed from a strictly commonsense point of view, what is the reasonable answer to the problem? To begin with, let us restate some evident facts:

1. It is obvious that refiners have gone the full limit of their resources.

2. The other side of the picture is that the volatile gasolines now available are highly desirable from the automobile engineer's point of view; they provide easy starting, which is an excellent selling argument for any automobile; and have a desirable knock rating and acceleration value.

3. Finally, although the range within which the refiner may work is strictly limited, the designer has a relatively wider range as is evident from the temperatures for the best and worst cars.

Quite logically, then, it is up to the engineer to tackle the problem seriously. Understand, we do not wish to imply that engineers are not doing anything about it. As a matter of fact, some manufacturers report that their new cars are reasonably free from vapor lock. But the situation will remain acute until all fuel lines are at normal temperatures.

Acknowledgement

Thanks are due the following, who gave helpful suggestions and read the original manuscript: W. S. James (Studebaker), J. C. Geniesse (Atlantic Refining), B. B. Bachman (Autocar), W. C. Bauer (Standard Oil Development), A. H. McInnis (Auburn). We also acknowledge our debt to the many other engineers and petroleum technologists whose cooperation made this study possible.

* "A Survey of Current Automobile and Bus Line Temperatures," S. A. E. Journal, March, 1931.

De Vaux Increasing

GRAND RAPIDS, MICH., May 18—Norman de Vaux, president of De Vaux-Hall Motors Corp., returned this week from a six weeks' trip to the Pacific Coast. He said that production in the Oakland, Calif., plant was now 50 cars a day and would be stepped up to meet May schedules, and that production at the Grand Rapids plant was now over 100 cars a day and would be increased steadily during the next 10 days, when a daily production of 125 cars is anticipated.

The models to be manufactured here for the first time are: the standard coupe with wood wheels, priced at $625; the business coupe with five wire wheels, priced at $645; sport coupe with rumble seat and five wire wheels, priced at $645; the sport coupe with rumble seat and five wire wheels, to sell at $675, and the custom coupe with rumble seat and six wire wheels, priced at $795.

To facilitate shipping of De Vaux cars, the company announced that new railway loading platforms and sheds are now being constructed. A train of 30 freight cars may now be loaded at one time.

Airplane Mileage Increases

NEW YORK, May 18—American air transport lines flew 7,427,614 miles during the first three months of the current year, as compared with 5,044,639 miles in the first quarter of 1930, according to a report just issued by the Aeronautical Chamber of Commerce of America, Inc.

All Chevrolet Schedules Up

Manufacturing and Assembly Operations On Five-Day Basis

DETROIT, May 23—All plants of the Chevrolet Motor Co. are now operating an average of five and one-half days a week, with workers back on a full-time basis, W. S. Knudsen, president and general manager, announced May 16.

The total company payroll is now in excess of 36,000 employees, and some plants are on a heavier productive basis than at any time since the fall of 1929, Mr. Knudsen said.

The manufacturing group of plants is now operating an average of six days and five nights a week, while the assembly plants are on a five and one-half day week basis. This is normal for both groups, Mr. Knudsen said.

As an unemployment aid, the company's policy last winter was to increase the number of men employed as soon as those on the payrolls averaged forty hours of work a week. At the current high rate of operations, however, plant workers are now averaging fifty hours a week. New workers have been added to the payrolls for several consecutive weeks, although only previous employees of the company are being hired.

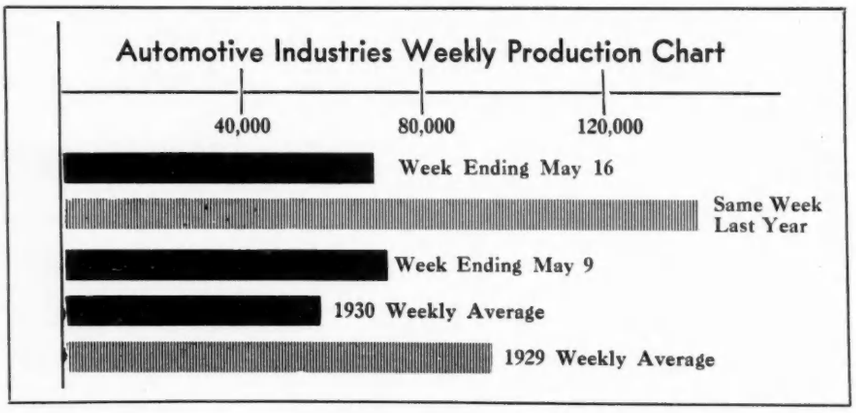
Current operations are generally at a higher rate than at any time since last May, Mr. Knudsen said.

To Fight Dole System

NEW YORK, May 19—The American Engineering Council, through its administrative board, has adopted a resolution, voting to combat, through its member societies, ill-advised measures arising either in the national Congress or in the state legislatures which might result in the dole system being inaugurated in this country to combat present unemployment conditions. The council is undertaking studies of unemployment reserve funds, unemployment insurance, and old-age pensions. It feels that any such relief measures should come from within industry itself, and not originate with the government, as the latter policy would soon degenerate into a dole system. Its studies are not only seeking to solve the present situation, but also to find a long range solution, to prevent future recurrences of the present crisis.

International Adds Two

CHICAGO, May 16 — International Harvester Company has announced two new 1½-ton truck models to be known as Model A-2 and Model B-2. They are similar in design, except as to rear axles and transmissions.



Planning Front Drives

WASHINGTON, May 19—A considerable number of French automobile companies are planning to bring out front-wheel drive cars in the near future and others are experimenting with the idea, according to advices to the Automotive Division, Department of Commerce, from assistant automotive trade commissioner, H. C. Schuette, Paris.

It is reported that both Donnet and Mathis expect to introduce low-priced front-wheel drive models in July, using the Tracta license. In the high-priced field, Delaunay-Belleville and Voisin are expected to bring out front-wheel drive models during the Paris automobile Salon in October. It is reported that Panhard is also conducting experiments with a view to producing a car with this traction principle.

To Confer on Planes

WASHINGTON, May 20—Suggested revisions in the Department of Commerce Airworthiness Requirements for Aircraft will be the subject of a conference to be held July 31 at the Department of Commerce in Washington between aircraft manufacturers and the Aeronautics Branch of the Department of Commerce, it was announced today by Col. Clarence M. Young, Assistant Secretary of Commerce for Aeronautics.

Dodge Trucks Gain

DETROIT, May 18—Continuing the upward trend that was noted early in April, retail deliveries of standard and heavy duty trucks by Dodge Brothers dealers for the period ending May 2 showed an increase of 4.6 per cent, as compared to the previous week, according to preliminary figures. Compared to the same period in 1930, this is an increase of 16 per cent.

See Improvement in Field

CINCINNATI, May 18—Enthusiastic over conditions in the automotive replacement parts field, following a tour of the Southeast, South and Southwest, Harry J. Hater, vice-president and general manager of Aluminum Industries, Inc., and F. J. Glennon, vice-president and general sales manager, returned to Cincinnati May 10. Although general conditions throughout the territory visited still are depressed, business in the parts and repair end is said to be showing a decidely improved tone and jobbers and dealers are declared greatly encouraged.

Petroleum Imports Drop

NEW YORK, May 20—Petroleum imports during the week ended May 16 are estimated at 182,714 barrels daily, as compared with 196,714 for the previous week and 203,714 barrels daily for the four weeks ended May 16, by the American Petroleum Institute.

Crude runs to stills during the week averaged 2,434,100 barrels daily, according to reports received from 95.7 per cent of the daily refining capacity; and plants owning 94.9 per cent of the potential charging capacity for all cracking units manufactured 3,194,000 barrels of cracked gasoline during the week.

Estates Output Drops

NEW YORK, May 20—Crude rubber production on the estates of less than 100 acres in size during April totaled 11,925 tons, as compared with 18,356 tons during March.

Estates of more than 100 acres, reported production during the month of 17,039 tons, as compared with 18,913 tons during March.

This is taken by the Rubber Exchange of New York as indicative of a declining rate of production in Malaya, especially in the native states, most of which fall in the group of less than 100 acres in size.

Triplex Ships More

CLIFTON, N. J., May 21—Sharp increase in shipments to automobile manufacturers in the past 30 days is reported by the Triplex Safety Glass Co.

In mid-April, shipments of nonshatterable glass from the company's factory here averaged 2500 lights a day. This figure during the second week in May has risen to 6000 lights a day. To handle the rising demand, equipment and workers have been added.

Employment Shows Gain

Michigan Report Shows Upward Swing Compared With March

DETROIT, May 19—Employment in the automobile industry in the State of Michigan, as of April 15, totaled 184,111, compared with 181,952 in March and 231,523 in April last year, according to a report by the state department of labor and industry, based on the reports of 68 companies.

The aggregate weekly payroll for the automobile industry in the state during April was $5,501,331, as against $5,275,324 in March and $8,144,389 in April, 1930.

Average weekly earnings per capita in the automobile industry were $29.88 in April, $28.99 in March and $35.17 in April last year.

Enacts Title Law

CHICAGO, May 20—The state of Ohio has enacted a certificate-of-title law affecting automobiles, which provides that the title shall be traced from the factory, instead of from the first dealer to sell the car, according to the May bulletin of the National Automobile Dealers Association.

Twenty-four states now have a certificate-of-title law in some form, according to the association, and in these states are registered about 50 per cent of the operating automobiles in the country.

Midland Shipments Up

CLEVELAND, May 21—The Midland Steel Products Co. during the first four months of 1931 shipped 25 per cent more of its mechanical four-wheel brakes than in the same period of 1930, according to E. J. Kulas, president of the company. May shipments of brakes are running at the highest level since April, 1929. The company is supplying brakes for eight automobile makers.

Motor Improvements, Inc., vs. General Motors Corp. and AC Spark Plug Co.

In the May 16 issue of *Automotive Industries* (p. 778) it was erroneously reported that the U. S. Circuit Court of Appeals, sitting in Cincinnati, April 17, had upheld a decision of the district court for Eastern Michigan, dismissing a complaint of Motor Improvements, Inc., in the matter of oil-filter patent infringements.

While it is true that the appellate court upheld dismissal of several items in the complaint, the claims covered in patents Nos. 1,594,334 and 1,594,335, of which Motor Improvements, Inc., is sole licensee, were remanded for further proceedings, thus reversing the earlier decision, with respect to these two patents, of the Michigan court. The two patents remanded set forth principally: (1) "A Method for Preventing Wear of the Moving Parts of an Automotive Internal-Combustion Engine," and (2) "Means for Filtering the Oil in the Lubricating System of an Internal-Combustion Engine."

According to J. A. Graham, president of Motor Improvements, Inc., the defendants (General Motors and AC Spark Plug) petitioned the Circuit Court of Appeals for a rehearing, which was denied in a decision handed down May 11.

S. A. E. Summer Meeting Program

Complete Details of Agenda for White Sulphur Set

(Continued from page 811)

SUNDAY, JUNE 14

Special Trains Arrive

7.13 a.m. From the East
7.56 a.m. From Detroit and Cleveland
Breakfast served at the Hotel

MOTOR TRUCKS and MOTOR COACHES SESSION

8.30 p.m. Auditorium
H. W. Alden, Chairman
Rating the Truck
M. L. Pulcher, Federal Motor Truck Co.
A Suggested Basis for Rating Trucks
L. R. Buckindale, Timken-Detroit Axle Co.

MONDAY, JUNE 15

FUELS SESSION

10.00 a.m. Auditorium
A. L. Beall, Chairman
Further Developments in Determining Gum in Gasoline
O. C. Bridgeman and E. W. Aldrich, Bureau of Standards
Fuel Line Temperatures in 1931 Motor Cars
O. C. Bridgeman and H. W. White, Bureau of Standards
The Interpolation Method in Detonation Testing
D. B. Brooks, Bureau of Standards
Carburetor Design for the Fuel Research Detonation Engine
C. S. Kegerreis, Consulting Engineer, Toledo

TRANSPORTATION SESSION

10.00 a.m. Ball Room
F. K. Glynn, Chairman
Utilization of Motorcoaches
D. A. Smith, Department of Street Railways, Detroit, Mich.

DIESEL ENGINE SESSION

8.30 p.m. Auditorium
W. F. Joachim, Chairman
Automotive Diesel Fuels
W. H. Butler, Standard Oil Co. of New Jersey
Practical Experience with Devices for Damping Torsional Vibrations
Erich Sandner, Consulting Engineer, Dortmund, Germany, and J. B. Fraunfelder, Consulting Engineer, Philadelphia
10.30 p.m. The Pool

WATER CARNIVAL

TUESDAY, JUNE 16

PASSENGER CAR BODY SESSION

10.00 a.m. Auditorium
L. C. Hill, Chairman
Comfort and Interior Appointments
H. A. Brunn, Brunn & Co., Inc.
What the Body Engineer Wants in a Chassis
R. F. Anderson, Murray Corp. of America
8.30 p.m. Auditorium

PASSENGER CAR SESSION

W. C. Keys, Chairman
The Tear-Drop Car
W. T. Fishleigh, Consulting Engineer, Detroit
Driving High-Speed Cars
J. E. Hale, Firestone Tire & Rubber Co.

WEDNESDAY, JUNE 17

FUTURE DEVELOPMENT SESSION

W. J. Davidson, Chairman
10.00 a.m. Auditorium
The Field for Synthetic Lubricating Oils
F. W. Sullivan, Jr., V. Voorhees, P. T. Oak and D. P. Barnard, Standard Oil Co. of Indiana
The Case in Favor of Cars With Rear Engine Mountings
Herbert Chase, Product Engineering and American Machinist

STANDARD SESSION

10.00 a.m. Ball Room
Arthur Boor, Chairman
Reports of the various Divisions will be presented and acted upon

FIELD DAY

2.00 p.m.
8.30 p.m. Auditorium

SEMI-ANNUAL BUSINESS MEETING

President Vincent Bendix, in the Chair

AIRCRAFT

Dr. G. W. Lewis, Chairman
Flying With the Navy
Hon. D. S. Ingalls, Assistant Secretary of the Navy for Aeronautics

Financial Notes

Stewart-Warner Corp. operations for the first three months this year resulted in a net loss of $331,757, after all charges and taxes. The loss in the first 1931 quarter compares with a net profit of $656,010, equal to 50 cents a share on $1,298,919 common shares in the corresponding period last year. Despite the operating loss for the period, the balance sheet as of March 31, 1931, discloses no marked weakening of current position revealed in the balance sheet as of December 31, 1930.

Current assets at the end of the first quarter of this year totaled $10,870,649 against current liabilities of $1,110,167. These figures compare with $11,362,864 and $1,170,800 respectively, reported at the close of the last calendar year.

Moto Meter Gauge & Equipment Corp. and subsidiaries report net loss for the first quarter of the current year $113,213. This compares with net loss for the first quarter of 1930 of $57,395.

Reynolds Spring Co. stockholders meet May 29 to vote on retirement of all preferred stocks, consisting of 5000 shares of class A preferred and 3600 shares of class B preferred, purchased and now held by the company. Stockholders will also act on a proposal to eliminate the authorized preferred and to reduce the authorized common stock to 200,000 shares from 1,000,000.

Jaeger Machine Co. directors voted Saturday a quarterly dividend of 20 cents a share on the common, establishing an 80-cent annual rate, compared with $1.25 previously maintained.

Bohn Aluminum & Brass Corp. has declared a regular quarterly dividend of 37½ cents on common stock, payable July 1 to stockholders of record June 15.

LeBlond-Schacht Truck Co. has declared its regular quarterly dividend of $1.75 on preferred stock, payable June 1 to stockholders of record May 25.

Graham-Paige Motors Corp. has declared quarterly dividend of $1.75 on first preferred stock, payable July 1 to stockholders on record June 15.

THURSDAY, JUNE 18

10.00 a.m. Auditorium

AIRCRAFT ENGINE SESSION

Arthur Nutt, Chairman
Air-Cooled Cylinder Head Design
Roland Chilton, Wright Aeronautical Corp.
Recent Valve Developments
A. T. Colwell, Thompson Products, Inc.
10.00 a.m. Ball Room

CHASSIS SESSION

E. S. Marks, Chairman
The Tire Factor in Automobile Riding Quality
R. W. Brown, Firestone Tire & Rubber Co.
Road Tests With the New Wabblemeter
Dr. F. A. Moss, George Washington University
Some Observations on Riding Qualities
Dr. Ammon Swope and Prof. H. M. Jacklin, Purdue University
Instrumentation as a Means for Coordinating Chassis and Body Design.
Athel F. Denham, Automotive Industries

AVIATION DEMONSTRATIONS

2.00 p.m.
8.30 p.m. Auditorium

GENERAL PRODUCTION SESSION

E. K. Wennerlund, Chairman
Cost to Industry of Labor Turnover
H. L. Horning, Waukesha Motor Co.

GRAND BALL

10.30 p.m. Ball Room

FRIDAY, JUNE 19

10.00 a.m. Auditorium

ENGINE SESSION

G. C. Brown, Chairman
Oil Control in the Engine
H. C. Mougey, General Motors Corp.
Winter Starting Tests
P. J. Kent, Chrysler Corp.
Reduction of Fan Noise and Fan Power
A. D. Gardner, Automotive Fan and Bearing Co.

SPECIAL TRAINS LEAVE

6.00 p.m. For Detroit and Cleveland
8.00 p.m. For the East
An early dinner will be served at the Hotel.

De Soto De Luxe Eight-Cylinder Sedan price has been set at $965 instead of $995, as previously reported.

Tool Builders Plan Campaign

Will Cooperate With Business Papers for Modernization

OLD POINT COMFORT, VA., May 19—Preliminary steps in a program of cooperation with the Associated Business Papers, Inc., in its recently initiated campaign to encourage the immedate modernization of production equipment in all industries were taken at the 29th Spring Convention of the National Machine Tool Builders Association held here on Monday and Tuesday.

The plan was outlined and its possible effect in stimulating business of all kinds was described, to the 95 members attending, by Earl Whitehorn for the A. B. P. committee in charge of the undertaking. At the opening session, Carl A. Johnson of the Gisholt Machine Co., president of the association, made an address on "Modernization—Our Opportunity to Stimulate a Revival of Prosperity," and reports were read by C. E. Randles of the Foote-Burt Co., treasurer of the association, and by Ernest F. DuBrul, general manager.

An executive session was held on Tuesday at which many matters of importance to the machine tool industry were discussed. Tweny-four group meetings were held during the convention by makers of the various kinds of machine tools.

The formal dinner was held on Monday night with Dr. G. W. Dyer, a well-known political economist, as principal speaker. On Tuesday afternoon a visit was made to the Newport News Ship Building Yards.

Midgets Finish Well

LONDON, May 10 (*by mail*)—In a field of 48 starters including cars of all sizes, five unsupercharged M. G. "Midgets" headed the list of finishers with average speeds ranging from 62.46 to 65.62 m.p.h. in the Double-Twelve hour race on Brooklands Track, which finished at 8 p.m. last evening. The fastest finishing car was a 3 litre Talbot, which, with a handicap minimum of 65.5 m.p.h., actually averaged 79.29 m.p.h.

Libby Glass Shipments Gain

TOLEDO, May 20—Shipments of safety glass to motor car makers by Libbey-Owens-Ford Glass Co. for the first half of May were greater than in any previous entire month, it was reported today. The East Toledo plant of the company is operating 24-hour capacity schedule.

Widespread Curtailment of Passenger Car Sales Reported

WASHINGTON, May 21—First quarter market surveys received by the Automotive Division, Bureau of Foreign and Domestic Commerce, indicate that the low commodity prices and general business recession had seriously affected the sales of automotive products in many foreign markets. The information on various markets as given below were condensed from the more complete reports furnished by the Bureau of Foreign and Domestic Commerce and the State Department. Reports more in detail on specific countries may be obtained by interested firms who are listed in the "Exporters Index," on application to the Automotive Division.

Colombia

With no noticeable improvement in business conditions in the first quarter of 1931, the market for automotive products was quiet. Limited numbers of low, medium and high-priced new American cars were introduced and sold without much difficulty. Dealers continued to decrease stocks, but new orders were light with the trend for low and medium-priced automobiles. American made cars dominated the market though a few Fiat cars were imported from Italy. These were sold in Bogota, which is about the only city in Colombia where other than American automobiles and trucks are in operation.

The used car market is now beginning to be a problem in this couuntry, but so far not enough to interfere with the expansion of sales of new models when the business situation improves. Liquidation of accumulated stocks is an important factor in limiting sales of new automobiles.

The demand for trucks remained fair in the first quarter with low-priced models leading in sales. An increasing number of buses are being used in Bogota as in other cities. Since stocks of trucks of 1 to 1½ tons and under are low it is expected that orders for these lines will continue to be placed. Stocks of high capacity trucks are relatively large with the demand small.

The market for motor cycles was very dull. The prospects for increased sales in 1931 are not promising. German and British makes, chiefly sport models, outnumber American motor cycles, particularly in Bogota and vicinity.

Cuba

January automotive sales were conceded to be the lowest which the trade has yet experienced. February was slightly better, and March showed a further gain. However, the volume of sales was very much below that of the same quarter of 1930, and dealers as a whole were very pessimistic as to the outlook for 1931. It was the general opinion that the interior parts of the island maintained sales better than Habana, which normally offers by far the largest market for all automotive products.

Stocks in the hands of importers and dealers at the close of the quarter were low to normal, in the case of the cheaper cars and trucks. In the medium-priced groups stocks were normal to high, and stocks of high-priced cars were generally high. Dealers have been making an effort to keep their stocks down to their actual requirements under present conditions, and are now very conservative in placing additional orders. A similar situation prevails in the case of trucks. Stocks of low-priced light models were light, but stocks of other models were somewhat high.

Dealers in replacement parts greatly delayed in placing orders, and it was not until about the 1st of March that any substantial buying was done. This buying occurred some four or five months after the normal time. It is generally reported that stocks were low and dealers were ordering only in small amounts for current sales. Sales of accessories and garage equipment practically ceased during the quarter.

During the first quarter, dealers made strenuous efforts to dispose of used cars even at substantial sacrifices, and considerable progress was made in this direction. While some dealers still have large stocks on hand, the situation was much better than at the end of December, 1930.

Germany

The International Automobile Show, which was held in Berlin beginning February 19, brought a revival of interest in automotive products. Most of the exhibitors reported an increase in business. This was so noticeable that during March a number of local plants revised their production schedules upward, and local firms supplying parts, bodies, etc., started full-time operations in order to catch up with increased orders.

This growing demand was mainly confined to the smaller, cheaper cars and cycle cars, and it is believed that the great bulk of sales in 1931 will be of this type car. American cars in the low-price class assembled in Germany are very popular and are obtaining an ever-increasing share of the total sales volume. It is very difficult for American manufacturers to secure representation in Germany at this time and some cars which have been on the market for several years are not now actively represented. The future of American car sales in Germany is believed by many to be in the higher price cars, sales of which can be made regularly to discriminating purchasers.

During the February automobile show attempts were made to American truck manufacturers not represented in Germany to secure agents, but these efforts were unsuccessful. The truck situation is similar to that of passenger cars, in that a few of the larger American companies with plants in Germany are obtaining the main share of the business.

New registrations of motor cycles during the first quarter were approximately 24,000, of which about 100 were American machines of three standard makes and mostly confined to larger and more powerful models. British firms are selling about twice as many as American motorcycles in Germany. The domestic industry is still suffering from the heavy production during the last three years, and dealers' stocks are high.

Mexico

Although there are, strictly speaking, no special selling seasons in the automotive trade of Mexico, the dealers do expect more lively sales during the first quarter, when most of them receive the new year's models. For the first quarter of 1931, the volume of sales did not reach the proportions experienced in previous years. Mexico City dealers did better than those of other localities, although dealer difficulties have operated to curtail the sales of low and medium-priced cars in the capital city. Interior dealers were forced to content themselves with a fair trade in low-priced cars and trucks.

While the outlook for increased motor vehicle sales is not particularly bright, the dealers are inclined to be optimistic. Most of them have reduced overhead to the minimum and have consolidated their positions, so that they can do business on a small, conservative basis.

Parts and accessory dealers do not share the optimism of car and truck distributors. They are faced with very stiff competition within their own ranks, and the available business to be obtained does not warrant such a condition. The accessory market is particularly unfavorable.

Netherland East Indies

The opening of 1931 was disappointingly quiet and the early year buying anticipated by importers failed to materialize. The trend of sales was definitely toward cheaper cars. The sale of medium-priced cars is expected to continue, but only by increased activity on the part of distributors will they be able to hold their position. The high-priced car market is at a standstill with little hope of improvement until economic conditions improve.

At the end of the first quarter 1931, less than half of the distributors representing American cars had introduced new models. This was regarded as an indication of the caution with which the automotive industry was

By Automotive Division in World Survey of Leading Markets

proceeding, apparently with a desire to avoid loading up with stocks as was done in 1930.

Dealers have adopted aggressive methods to keep used car stocks low. This situation was very acute in 1930 and particularly in the fourth quarter of that year. However, stocks were greatly reduced by forced sales and a more careful policy of accepting trade-ins. Most dealers are reported to be carrying no more than four to six weeks' supply of these cars on hand and to be disposing of them at almost any price within reason rather than to wait for better offers.

The depression has seriously affected the groups which in the past have been the largest purchasers of motorcycles, namely, clerks and junior executives. Salaries have been cut and many firms have reduced personnel, thus further limiting the number of sales prospects. Stocks are high and it is believed that it will take heavy liquidation to bring them down to normal.

New Zealand

A study of the registration figures for January and February would indicate that 1931 will be a difficult automobile year. Total passenger car registrations for the first two months of this year were 1189 as compared with 3131 for the same period in 1930. January and February are usually two of the best selling months in the year for the motor trade and the decrease in registration is causing consternation among all motor interests in the Dominion.

In the past American manufacturers have accounted for some 80 per cent of passenger car sales, but this decreased to 55 per cent during the two opening months of the year. British makes secured 45 per cent of sales, the largest percentage they have enjoyed on the market in many years. In commercial vehicles 90 per cent of total registrations continued American, mainly owing to registrations in two makes of low-priced trucks.

The "baby" car retailing in New Zealand in the vicinity of $1,000 is the car on which the British have based their drive on this market, and 90 per cent of the British sales made in 1931 have been of that type. The little car seems to make a definite appeal due to the difficult economic times which makes the initial price and operating costs much more important than ordinarily. Road conditions in the past five years have undergone a vast improvement and the better roads have made it possible for these small cars to be serviceable in sections of the country where hitherto they could not penetrate.

A survey completed at the end of March showed stocks of about 5200 new cars on hand which had not been registered. Of this number English cars accounted for approximately 1200 and American makes the remainder. Under present conditions, stocks were believed to be ample for seven to eight months. Used car stocks also were heavy, totaling approximately 5500 units. Sales are slow and dealers have cut prices severely in order to clear their floors of these old vehicles.

Northern Ireland

In spite of adverse business factors there was a slight improvement in the automotive market, especially during the month of January. The greater number of cars sold were of low horsepower, only 25 per cent being over 14 hp. The most popular cars appeared to be the Austin and the Morris. With the exception of one American car and two American trucks and the French Citroen, few foreign cars entered the market of Northern Ireland.

In view of the losses that were sustained in 1930 by private bus and municipal companies, there was a definite desire on their part to economize during the first quarter of this year, thus bringing about a lull in the sale of buses. At present no new extensions of services are contemplated and sales during the next few months will probably be for replacement purposes only.

The sales outlook for trucks appeared favorable and in view of the leading position trucks of American design have in this market, there is every indication that they will benefit by any increase. The market is naturally limited in volume and the American vehicles sold are in the light-weight class.

The very high percentage of English cars in use gives British manufacturers virtual control over the parts and accessories market. Another reason for this control is the fact that dealers do not care to import direct, but depend on being able to purchase supplies as needed from such points of central distribution as London, Liverpool and Glasgow.

Porto Rico

New registrations of passenger cars during the first quarter of 1931 totaled 704, an increase of 195 over registrations for the same period of 1930. The demand continued in favor of the lower-priced passenger cars and there was a strong movement in favor of medium and low-priced trucks. Two new lines of trucks were placed on the market, thus bringing the number of trucks now represented to two low-priced, six medium-priced and one high-priced.

There was virtually no demand for motorcycles. The few motorcycles on the island belong to the police, the army and to a few individuals. Efforts of several American firms not manufacturing cars to sell parts for standard models have met with very little success, due to the fact that distributors are the only people keeping stocks, and supplies are usually secured from the manufacturers themselves. Stocks of parts on hand have been reduced from the 1929 level and most distributors' accounts are in good order.

Portugal

Registrations of automotive vehicles during January and February totaled 327 as against a monthly average of 328 in 1930. The principal factor affecting sales during the quarter were the lack of money and the inability of dealers to obtain better facilities from the banks. The sale of passenger cars for taxicabs fell off considerably. The competition in the taxi business is very severe and dealers hesitate to extend further credits in that direction.

American motor trucks continued to meet competition from Citroen and Fiat, but during the two first months of the year, European trucks accounted for only 13 out of a total of 117 units registered in the countries. The demand was for light chassis equipped with locally built bodies. Truck dealers in rural districts have had a difficult time because of the unfavorable agricultural conditions and their inability to discount paper with small banking houses.

The motorcycle market was largely in the hands of the British makes during the quarter. The existing demand is for lightweight vehicles. Side cars are little used. British motorcycles also are popular because of their low initial and operation costs and the liberal terms on which they can be purchased.

Rumania

Competition among the various American cars was very keen during the first quarter. This competition was stimulated by a desire to clean out old stocks and prepare for the new models. The market was also affected by the forced sale of several consignments of low-priced cars that were taken over by factory representatives and which had remained at the customs for many months.

Foreign competition was largely confined to the Renault and Fiat. Dealers in these cars use aggressive sales policies and offer very attractive terms to prospective buyers. These companies gave terms of 12 to 18 months at 7 per cent interest, which they were able to offer with the aid of credit insurance provided by the French and Italian governments.

The poor condition of the roads mitigates against a more rapid increase in the use of trucks and buses. The demand is principally for 1½ to 2-ton-capacity vehicles.

Men of the Industry and What They Are Doing

U.S. Rubber Names Moody

Appointment of C. L. Moody as factory manager of the main plant of the U. S. Rubber Company's tire department in Detroit is announced by J. F. O'Shaughnessy, general manager of the department. Mr. Moody succeeds Earl L. Bryant, who will devote his entire time to special work in the coordination of tire factory operations.

Before assuming his present position, Mr. Moody was manager of the Dominion Rubber Company's tire factory at Kitchener, Ont. This company is the Canadian subsidiary of the U. S. Rubber Co. Before joining the organization of the U. S. Rubber Company Mr. Moody was general superintendent of the Fisk Rubber Company's plant at Chicopee Falls, Mass.

Meadowcroft Addresses Philadelphia Welders

J. W. Meadowcroft, assistant works manager of the Edward G. Budd Mfg. Co., was the principal speaker at the final meeting of the season of the Philadelphia Section, American Welding Society. Mr. Meadowcroft traced the development of transportation from the Egyptian chariot to the modern automobile. His talk was illustrated with a motion picture showing various aspects of Budd body production.

Olds Names Daly

George F. Daly has been appointed manager of the Oldsmobile Atlanta zone, according to an announcement by J. T. Collins, general sales manager of Olds Motor Works. Mr. Daly is transferred from Charlotte, where he has been zone manager for some time. Previously he had been a factory representative in the Atlanta zone.

Mrs. Wilson Elected

Mrs. Alfred G. Wilson, the former Mrs. John Dodge, yesterday was elected chairman of the board of Fidelity Bank and Trust Co.

Mrs. Wilson has been a director of the company since 1924.

Burr Visiting Territories

F. H. Burr, director of the automotive division of the Cleveland Pneumatic Tool Co., is making a survey of the southern and southeastern parts of the United States.

Attend O.R.C. School

Major B. J. Lemon, Lieut. N. E. McLaughlin and Lieut. Herbert Poehle, of the U. S. Rubber Company's tire department, attended the sessions of the motor transport school conducted at the Army Reserve Camp at Erie Ordnance Depot, Port Clinton, Ohio, in May.

These executives of the U. S. Rubber Co. in Detroit are actively connected with the Detroit Procurement District Headquarters, Motor Transport Reserve.

Loranger Succeeds R. E. Chamberlain

R. E. Chamberlain, general sales manager of the Packard Motor Car Co. for the last 10 years, has been appointed Packard distributor in Buffalo by the Packard company. His appointment will become effective June 1. He is succeeded as Packard Motor Car sales manager by J. W. Loranger.

De Soto Names Palmer

John J. Palmer, who has been associated with the De Soto Motor Corp. since its inception, has been appointed to the personal staff of Byron C. Foy, president, as assistant to the president. He was formerly assistant general sales manager for the company.

Producing Wheel Disks

NEW YORK, May 18—Nil Melior, Inc., have started production on wheel disks as a new de luxe accessory for all makes of cars. These disks have been manufactured abroad for a number of years, but have just been introduced in this country by the Nil Melior Company. These disks are for super-imposing on wheels of other types.

N.A.C.C. Meeting Changed

NEW YORK, May 19—Directors of the National Automobile Chamber of Commerce will hold their June meeting on Thursday, June 4, instead of the previous day, which would fall in with its regular schedule. The members' annual meeting for election of officers and directors will be held the following day, Friday, June 5.

Delco Adds 2 Radios

DAYTON, May 20—Two new radio receivers, designed especially for police work, have just been announced by the Delco Radio Corporation. One, of the automotive type, is featured by use of the Pentode tube, and is said to be the first automotive radio to employ this new type of tube. The other set is a police station receiver.

Issues Year Book

NEW YORK, May 19—The Tire and Rim Association, Inc., has just issued and mailed its 1931 Year Book.

Paradox Rules Steel Market

Price Shading Accompanies Sentiment For Higher Profits

NEW YORK, May 21—The steel market presents the anomaly of relatively mild resistance to a further easing off in current prices by the side of more determined efforts on the part of producers to make third-quarter business yield them a somewhat more satisfactory margin. The bar base price of automotive alloy steels has receded $4 a ton to 2.45 cents, f.o.b. mill, operations being on about a 45 per cent of capacity rate.

With leading sheet rollers following the example set by one of the prominent "independents" in the method of classifying and quoting prices, a transition period with minor price irregularities is in evidence; but the main objective of this reform, that of putting the market on a more rational basis in the relation of prices for one kind of sheets to the others, bids fair to become an accomplished fact before long.

An important strip steel producer in the Chicago district announced this week prices about $1 a ton higher than those at which business has recently been done, and a firmer stand on third-quarter prices is looked for by strip steel mills generally. There is not likely to be a formal announcement of third-quarter prices on bars, shapes, and plates until after June 1, and the general expectation is that old prices, which of late, however, have been strictly nominal, will be reaffirmed and that sellers will endeavor to make them more effective than they were during the current quarter.

Developments this week again emphasize the program of prominent "independents" to centralize the production of automobile sheets in Detroit district mills.

Entirely unconfirmed and so far unconfirmable rumors have been making the rounds that the leading steel producing interest is considering the Detroit district as a possible location for additional rolling facilities. The Mahoning Valley mills continue to have a good run of automotive orders, permitting sheet mills to operate at a much better rate than primary plants.

Pig Iron—Middle West automotive foundries are buying moderately, but, at that, furnish the one bright spot in an otherwise drab market. The Buffalo market is down 50 cents a ton.

Aluminum—One of the Swiss producers shipping metal into the American market is reported to be curtailing production. The market is quiet and unchanged.

Copper—Producers have lowered export prices and wire drawers have revised prices downward. The domestic market was almost idle at the beginning of the week, producers quoting 9 cents, delivered Connecticut Valley, and 9⅛ cents, delivered Middle West.

Tin—Responding to a decision by the International Tin Committee at a meeting at The Hague to cut output another 20,000 tons per annum, the market advanced.

Reading System Files Brief with I. C. C. Advocating Higher Taxation of Bus Lines

WASHINGTON, May 18—Motor truck and bus highway carrier taxation upon the basis of approximately 10 per cent of their gross revenues is urged by the Reading Company in a brief filed with the Interstate Commerce Commission last week in connection with the commission inquiry into motor-rail coordination. This proposal is seen in the charge of the Reading Company that "the highway carrier is subsidized by the public in the States of Pennsylvania and New Jersey to the extent of charges amounting to about 10 per cent of its gross revenue."

The commission is urged to give serious weight to the "present unfair conditions as to taxation affecting the railroads and the highway carriers," and recommendation is made to the states that they take action "to remedy the tax inequality between the competing forms of transportation."

The brief declares that statements of the highway carriers "show merely as a general rule that the license fees and gas taxes paid by all users of the highway are now sufficient to provide for the construction and maintenance of the highways." It is pointed out, however, "that by far the larger part of the funds so derived by the states are paid by citizens who use the highways as they were intended to be used—as a means of traveling from one place to another."

In an effort to support its position that the highway carriers are not making an adequate contribution, the Reading Company makes a comparison between taxes paid by it and its highway subsidiary, the Reading Transportation Co. It is pointed out that of the latter's taxes only $7,353.19, or 1.69 per cent of its gross revenue, was applicable to the general purpose of government. In return for these taxes, the brief states, the highway carrier secures in common with other carriers a modern right-of-way involving no capital expense to itself, but constructed and maintained out of public funds. In contrast, it is stated, the rail carrier, in addition to paying more than 5 per cent of its gross revenue for taxes, is obliged at its own expense to provide and maintain its own right-of-way.

The expense of merely maintaining the railroad right-of-way, the brief says, for the year 1929 was $10,671,386.38, or 10.6 per cent of the gross revenue of the Reading Company. On the other hand, according to the brief, the Reading Transportation Co. by the payment of taxes aggregating $16,520.18 secured the use of highways as a private right-of-way at the cost of only 3.3 per cent of its gross revenue.

Taxes and maintenance of its right-of-way, the brief says, cost the Reading Company almost 16 per cent of its gross revenue against 5½ per cent for its highway subsidiary. Striking the difference between the two prompted the statement of the so-called subsidy to the latter.

"It is this handicap of which the railroads justly complain," says the brief. "The usefulness of highway transportation is recognized and admitted. The railroads have no thought of trying to regulate or legislate highway transportation out of existence; they ask only that highway carriers be subjected to regulation in the public interest corresponding to that which the public has deemed necessary in the case of the railroads, and that highway carriers be subject to taxes on an even basis with the railroads.

"If this is done the railroads will have no complaint. And when it is done, the highway carriers will no longer have the unfair opportunity which they now enjoy to fix rates on a lower basis than is possible for the railroads, burdened as they are with the expenses of regulation and taxes."

Fatalities Increase

NEW YORK, May 18—An increase of more than 9 per cent in the automobile fatalities in the first quarter this year was found in a survey based on reports from most states, prepared by the Travelers Insurance Co. More than 180,000 persons were injured, 6600 fatally, in 162,000 automobile accidents during the period.

The accident record shows that in New York State 378 persons were killed, against 391 in the first three months last year, a decline in the rate of 3.32 per cent. The greatest increase in the percentage ratio came in Oregon, where 69 persons were killed, against 27 last year, an increase of 155.56 per cent. California had the greatest number of fatalities, 566, which compares with 522 in the same period last year, an increase of 8.43 per cent.

Arvin Orders Increase

CHICAGO, May 18—Orders booked by the Arvin automobile heater division of Noblitt-Sparks Industries, Inc., are substantially larger than those on the books a year ago, Q. G. Noblitt, president of the company, stated yesterday. Jobbing and trade in automobile heaters have been expanded materially, Mr. Noblitt states.

J. C. Bayless

SOUTH BEND, May 18—J. C. Bayless, assistant treasurer of the Studebaker Corp. for the past 12 years, died here recently.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, May 19—The cool and rainy weather over much of the country last week had a very depressing influence on retail trade, although there was a slight improvement in wholesale and jobbing lines, especially in silks and some kinds of cotton goods.

GUARANTY INDEX

The Guaranty Trust Co.'s preliminary business index for April stands at 73.8, as against 72.3 for the month before, and 94.0 a year ago.

MERCHANDISE EXPORTS

The value of merchandise exports during April amounted to $217,000,000, the lowest for any month during the current depression, as against $235,895,000 during March and $331,732,000 a year ago. Imports during April totaled $187,000,000, as against $210,200,000 during the preceding month and $307,824,000 a year ago.

CAR LOADINGS

Railway freight loadings during the week ended May 2 totaled 775,291 cars, which marks an increase of 16,019 cars above those during the preceding week, but a decrease of 167,383 cars below those a year ago, and a decrease of 276,644 cars below those two years ago.

CONSTRUCTION AWARDS

Construction contracts awarded in 37 Eastern states during April, according to the F. W. Dodge Corp., amounted to $336,925,200, as against $482,876,700 a year ago.

COTTON CLOTH OUTPUT

Production of standard cotton cloths during April, according to the Association of Cotton Textile Merchants of New York, amounted to 225,955,000 yds. Shipments were equivalent to 96.3 per cent of production, and sales were equivalent to 61 per cent of production.

CRUDE OIL OUTPUT

Average daily crude oil production for the week ended May 9 amounted to 2,468,700 bbl., as against 2,475,100 bbl. for the preceding week and 2,595,150 bbl. a year ago.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices for the week ended May 16 stood at 71.8, as against 72.0 the week before, and 73.1 two weeks before.

BANK DEBITS

Bank debits to individual accounts outside of New York City during the week ended May 13 were 26 per cent below those in the corresponding period last year.

STOCK MARKET

The stock market last week continued its downward course, and rallies from time to time failed to reach appreciable proportions. As has been the case in many weeks preceding, the railway issues were particularly affected. Most issues suffered net losses for the week, and in several cases the losses were large. Call money at the beginning of the week was available at 1 per cent, the lowest level since 1908.

BROKERS' LOANS

Brokers' loans in New York City during the week ended May 18 declined $28,000,000, making a total contraction of $178,000,000 for the four weeks ended May 13.

RESERVE STATEMENT

The consolidated statement of the Federal Reserve banks for the week ended May 13 showed decreases of $5,000,000 in holdings of discounted bills and of $41,000,000 in holdings of bills bought in the open market. Holdings of government securities remained unchanged. The reserve ratio on May 13 was 84.5 per cent, as against 83.4 per cent a week earlier and 84.0 per cent two weeks earlier.

Hug Adds Two Sixes

New Models Will Carry Maximum Loads of 6000 and 8000 Lb.

HIGHLAND, ILL., May 19—Two new six-cylinder trucks, a two and a three-tonner, are the latest additions to the Hug Company's line of commercial express models. While these two new units, Model 23 and Model 42, carry maximum load capacities of 6000 and 8000 lb., respectively, they are, with the exception of differences in rear axle, brake drum and shoe and tire sizes, essentially companion models, being assembled of the same major units. Both are furnished in 160, 175 and 185-in. wheelbases, but Model 42 is also available in a short 150-in. and a long 195-in. wheelbase.

The engines are 3¾ x 4½-in. Model H-298 Budas, developing 86 hp. at 3000 r.p.m. Other specifications include Borg & Beck clutches, Fuller 4-speed transmissions; Clark spiral bevel axles, Ross gear; four-wheel hydraulic service brakes and disk parking brakes mounted at center of double propeller shafts, and pressed steel 8 x 3 x ¼-in. frames. Additional details are furnished in the specification tables (page 63).

Bendix Brake Sales Up

SOUTH BEND, IND., May 18—The Bendix Brake Co., subsidiary of Bendix Aviation Corp., reported May 16 that its shipments have increased 15 per cent monthly since the first of this year. This was announced today by Vincent Bendix, president of the parent corporation.

Business this far in May indicates that the per cent increase will remain constant for an indefinite period, inasmuch as replacement parts business also has held steady.

National Orders Gain

CHICAGO, May 18—April sales of the National Standard Company were the largest for any month since May, 1929, W. F. Harrah, president, announced today. The present outlook indicates that May sales will be fully as good as those of April.

Toledo Replacements Gain

TOLEDO, May 18—An increase of 26 per cent in the sale of replacement parts for the first four months this year, over the same four months the preceding year, has just been reported by the Toledo Steel Products Company.

Yellow Reelects Directors

PORTLAND, ME., May 18—At the annual meeting of the stockholders of Yellow Truck & Coach Mfg. Co. held here May 14, the present directors were reelected.

+ + CALENDAR + + OF COMING EVENTS

SHOWS

International Garage Exposition, Berlin, Germany .....May 9-Aug. 9

CONVENTIONS

Retail Delivery Assn. Convention, Washington, D. C. .....May 25-28

National Foreign Trade Council, New York .....May 27-29

Natl. Automobile Chamber of Commerce, New York City (Directors' Meeting) .....June 3

Natl. Automobile Chamber of Commerce, New York City (Members' Meeting) .....June 4

S.A.E. Summer Meeting, White Sulphur Springs .....June 14-19

Steel Founders Society (Mid-Summer), French Lick, Ind....June 17-19

National Association of Credit Men, Boston, Mass. .....June 22-27

American Society Mechanical Engineers, Madison, Wis. (Oil and Gas Power Meeting).....June 23-26

National Association of Taxicab Owners, Chicago, Ill. .....June 29-30

S.A.E. Aeronautic Meeting (in conjunction with Natl. Air Races), Cleveland, Ohio .....Sept. 1-3

Eastern States Exposition, Springfield, Mass. .....Sept. 20-26

American Welding Society, Boston, Mass. .....Sept. 21-25

National Safety Council, Chicago, Ill. .....Oct. 12-16

Society Industrial Engineers, Pittsburgh, Pa. .....Oct. 14-16

Transportation Meeting, S.A.E., Washington, D. C. .....Nov. 10-12

Soviets Buy SKF Plant

WASHINGTON, May 21—The industrial concession in Soviet Russia of the SKF, Swedish ball and roller bearing company, has been purchased by the Soviets, according to Swedish information forwarded to the Department of Commerce by Commercial Attache T. O. Klath, Stockholm. The purchase price and other particulars have not been made public. It is reported that the Soviets will take over the production while SKF will supply a number of engineers as technical advisers.

The SKF plant at Moscow has an annual capacity of 3,000,000 ball and roller bearings. The Soviets now plan to build a larger ball bearing plant for whose construction SKF will supply engineers, the report says. The agreement between the Swedish company and the Soviets is supposed to have been entered into under mutual understanding and SKF is reported to have said the agreement is satisfactory to it.

Auburn Adds 48 Dealers

AUBURN, IND., May 18—The Auburn Automobile Co. has announced the addition of 48 new dealerships to its distributing channels, during the week preceding this date.

Gotfredson Adds to Line

Four or Six-Cylinder Engine Option Distinguishes New Types

DETROIT, May 19—Two new 1½-ton chassis, identical except for the engine, one of which is a four and the other a six, have been announced by the Robert Gotfredson Truck Co. The four, priced at $975, is designated as RB34, and the six, termed RB36, sells for $1,075. Both carry a gross weight rating of 10,100 lb. and are offered in a standard wheelbase of 136 in. and maximum of 157 in. Engines are unit-mounted Budas.

The four is a 3¾ x 4½-in. Model H199 developing 55½ hp. at 2800 r.p.m. and the six a J214 developing 61.5 hp. at 3000. Other major units include Clark 4-speed transmission, Clark front and rear axles, Spicer universal joints, Ross steering gear, Midland 5¾ x 2¾ x ¼ in. steel frames and Detroit Steel Products springs. Electrical equipment is supplied by Delco-Remy and the fuel system embodies a Zenith carburetor.

The braking system consists of 4-wheel hydraulics for service and an external band on transmission for parking. Cast steel hollow spoke Budd wheels equipped with 6.50/20 in. balloons are standard. Head and fender lamps as well as aluminum radiator are finished in chromium plate.

White Adds Two Series

CLEVELAND, May 18—In order to provide a complete overlapping range of models from 8000 to 13,000 lb. gross weight specifically fitted for particular operating conditions, the White Co. has inserted two new series in this range. These are Models 601 and 602 and Models 611 and 612.

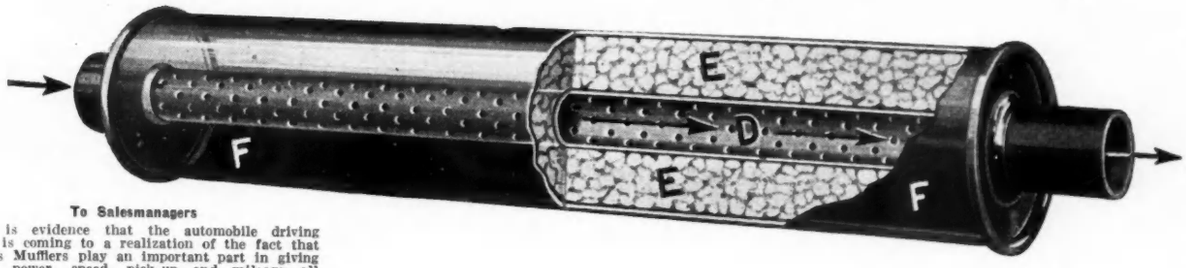
Models 601 and 602 are almost identical with Model 60, which will be continued, except that they carry 7.00/20 and 7.50/20 balloon tires, respectively. Model 601 is gross rated at 11,500 and priced at $2,550, which is 1000 lb. and $100 more than Model 60. Model 602 carries a gross weight rating of 13,000 and is priced at $2,800.

Model 61 fitted with 35 x 5-in. pneumatic tires, rated at 8000 lb. and listing at $1,850, is the basic model from which Models 611 and 612 are derived. Model 601 has 7.00/20 tires, is rated at 10,000 lb. and priced at $2,050.

Morse Chain Orders Gain

CHICAGO, May 18—Orders of the Morse Chain Co., division of Borg-Warner Corp., on hand May 1 showed an increase of approximately 19 per cent above April.

BURGESS MUFFLERS
Increase their Popularity



To Salesmanagers

There is evidence that the automobile driving public is coming to a realization of the fact that Burgess Mufflers play an important part in giving greater power, speed, pick-up and mileage—all vital points in selling the modern automobile.

The car manufacturers who are using Burgess Straight Thru Full Power Exhaust Mufflers know the following to be true.

Pioneering in the Study of Sound

Burgess engineers specialize in the study of sound (noises) pertaining to buildings, automobiles, air ducts, ventilators, aeroplanes, motor boats—in fact, acoustics in general. The following are some of our acoustic products:

- *Intake silencers for automobiles.*
- *Silencers for air compressors and blowers.*
- *Acoustic units for quieting air ducts and engine compartments.*
- *Acoustic window ventilators.*
- *Acoustic correction in buildings.*

Our engineers are ready to help solve your noise problems.

TWO more of America's leading manufacturers of fine passenger cars have recently standardized on Burgess Mufflers.

Burgess Mufflers are now standard equipment on twelve models of passenger cars and many commercial vehicles.

We make this announcement of progress with a deep sense of the responsibility which it involves for maintaining schedules and high quality of workmanship and with pride in the fact that our contribution toward greater efficiency in the application of power is being recognized by the automotive engineers.

Full Power

Due to the "straight-thru" construction back-pressure is reduced to a minimum, thus increasing engine horsepower. The Burgess Straight-Thru Muffler is the same as a cut-out minus the noise.

Faster Pick-Up

Every test with the Burgess Muffler has clearly indicated a faster Pick-up—which is due to its "straight-thru" construction.

Added Top Speed

By causing increased Horsepower, the Burgess Straight-Thru Muffler has definitely delivered added Top Speed.

Increased Mileage

Reduced back-pressure shows a noticeable increased mileage per gallon of gasoline with the Burgess Straight-Thru Muffler.

Acoustical Characteristics

The sound waves expand into the absorbing material and are destroyed. This is accomplished without hindrance to the flow of gases and the result is excellent muffling.

General Application

We manufacture all types and sizes of exhaust mufflers for combustion engines including Diesel engines; for carburetor intake silencers and for air compressor intakes.

We shall welcome an opportunity to work with you on your muffler problems.

BURGESS BATTERY COMPANY
111 WEST MONROE ST.
CHICAGO

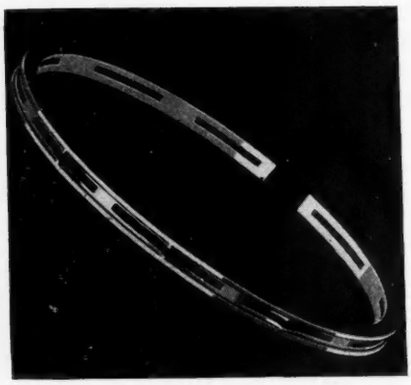
BURGESS

ENGINEERS AND MANUFACTURERS OF ELECTRIC AND ACOUSTIC PRODUCTS

New Automotive Developments

Wilcox-Rich Piston Ring

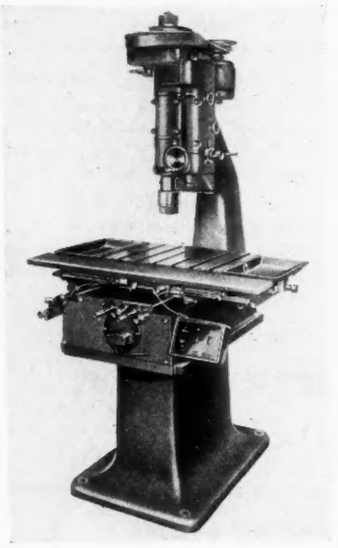
A NEW design of oil-control piston ring said to assure an unusually high unit pressure against the cylinder wall, is being announced by the Wilcox-Rich Corp., Detroit, Mich. These rings are individ-



ually cast from electric furnace iron, cam-turned patterns being used. The oil-control action depends upon a combination of milled slots and interrupted grooves.

Keller Jig Boring Machine

THE Kellocater jig boring machine for fast, low cost precision jig boring and layout work was recently placed on the market by the Keller Mechanical Engineering Corp., Brooklyn, N. Y. The only measuring device is a Vernier of which one scale measures the longitudinal movement and another the transverse. This construction eliminates the use of several measuring elements. Settings are readily made without moving work or table by lining up sharply drawn graduations. One of the interesting features of the machine is the electrical stop by means of which the location is automatically made. By snapping a toggle switch the machine is moved at a uniform speed, and as the contact touches the anvil of the Vernier slider, the magnetic clutch releases the lead screw and stops the table at the proper location within an accuracy of 0.0002 in.

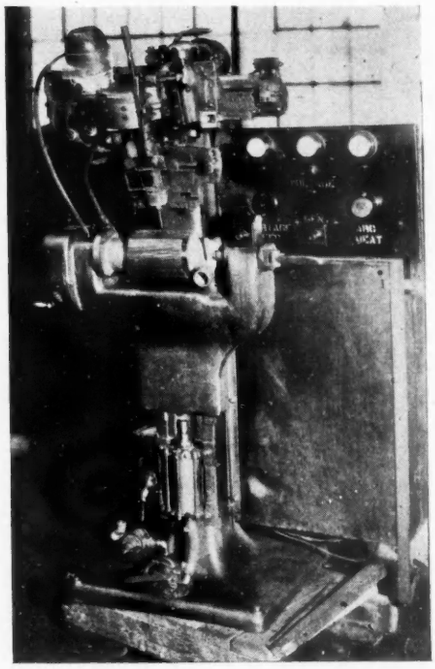


Eight spindle speeds, 77 to 1750 r.p.m., are available, four through an open belt and four through back gears. In addition, there are two reversible automatic speeds and a choice of hand wheel and hand lever feed. The machine is driven by a ½ hp. motor, weighs 1375 lb. and requires a floor space of 55 x 45 in.

Lincoln Welders Attach Fins

AN automatic machine for arc welding copper cooling fins to the exterior surface of cast-iron cylinders of automotive engines, utilizing the Electronic Tornado process, has been developed by The Lincoln Electric Co., Cleveland, Ohio.

The job performed by this automatic arc welding machine consists of welding 112 copper fins, each



3/32 inch thick, to the exterior wall of a cast-iron cylinder. The fins are the same length as the cylinder and are Z-shaped. It is claimed that with this method the cylinders are held at a temperature about 100 deg. F. cooler than those with the fins cast in, under identical load conditions.

G. E. Welding Control

INTERMITTENT line and spot welding with interruptions as high as 1000 per min. are possible with a new type of control equipment announced by the General Electric Co., Schenectady, N. Y. This control uses "thyratron" tubes instead of contactors for interrupting the flow of current.

In addition to the advantage of the high speeds which can be obtained—contactor wear is eliminated, both on the contactor tips and the entire mechanical assembly.

The pace of industry has quickened since the days when men worked patiently by hand. ☆ ☆ ☆ To-day high speed machines click out work with a precision undreamed of a century ago. ☆ ☆ ☆ Yet behind the machine is the skill of the man—as important as in the days of benchwork. Such craftsmanship is apparent in the enduring quiet and beauty of the All-Steel Body.

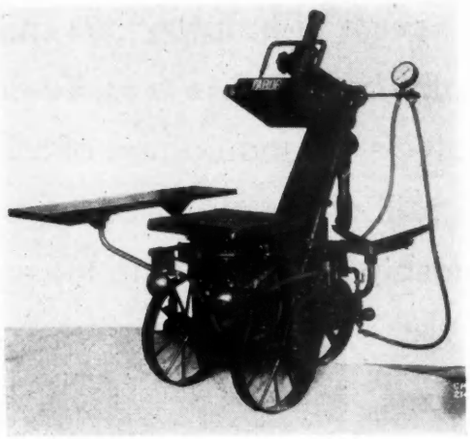
★BODIES BY BUDD★

Originators of the All-Steel Body. Used to-day by manufacturers in the United States, Great Britain, France and Germany.

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

Cipco Polishing and Buffing Machine

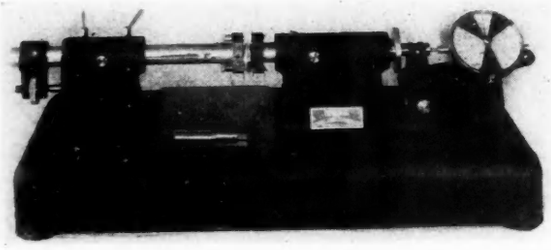
THE polishing and buffing machine described on page 630 in the April 18, 1931, issue of *Automotive Industries* is the product of the C. Packer Tool & Die Co. at 106 Britannia St., Meriden, Conn.



Federal Three-Wire Screw Thread Gage

A NEW screw-thread gage employing the three-wire method of measuring, designed for checking taps, screws, thread gages and the like, originated by the J. M. Carpenter Tap & Die Co., Pawtucket, R. I., has been placed on the market by the Federal Products Corp., Providence, R. I.

In principle the individual wire is floating and the two other wires are semi-floating and can be readily changed to allow for different sizes. The dial indicator, which is graduated in 0.0001, is 3⅝ in. in diameter and the dial is calibrated 0-5-0 and



equipped with a tolerance shutter for easy reading. This gage has an adjustable spring pressure against the part to be gaged from ½ to 6 lb. The work can be checked vertically or horizontally as desired, and the tail stock is provided with a Vernier adjustment. The instrument can be operated either by hand or foot by means of a small lever shown at the right. The overall length is 24 in. Weight is approximately 200 lb.

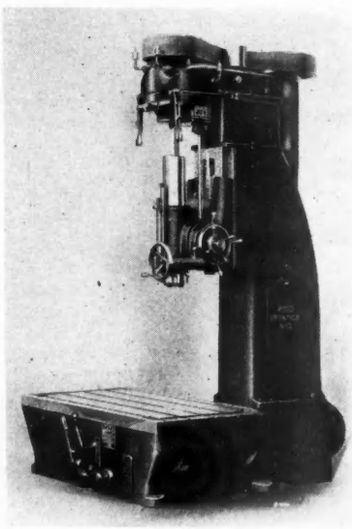
Tabor Plain Squeezer

THE Tabor Mfg. Co., Philadelphia, Pa., has just added to its squeezer line the Tabor Plain Squeezer with a cantilever yoke. This machine is furnished in both Plain Squeeze and Jar Squeeze types. It is claimed that the yoke operates with facility, while at the same time, it is perfectly rigid. The pins on which it swings are not used for adjustment to accommodate different depths of flasks, but are permanent, working in accurately reamed replaceable bushings. The yoke and link are of steel and the link has an exceptionally wide base. In the squeezing position, the yoke has a three-point support, the third point of support being fixed; this method of mounting adds greatly to its rigidity. Even after long service there need be no fear of ram-offs. The ramming block is readily adjustable, requiring only a few seconds time of one man to change for different flask depths. The machine is sand-proof and all guide rods are inside the main cylinder. The squeezing piston is protected with a cast iron sand guard.

The machine is furnished either stationary or portable. Even when portable, the wheels have an overall spread of only 22 in. and but 26 in. is needed behind the machine to allow for the complete backward travel of the yoke.

Reed-Prentiss Vertical Jig Boring Machine

ANNOUNCEMENT is made by the Reed-Prentiss Corp., Worcester, Mass., of their No. 5 Special Vertical Jig Boring Machine which was recently developed for boring the top and bottom sections of cast iron sub-presses. Eighteen spindle



speeds, 25 to 900 r.p.m., and feeds of 0.005, 0.010 and 0.020 per revolution, are provided. The spindle travel accuracy is guaranteed within limits of plus or minus 0.00025 in 15 inches. The solid box table is 36 x 70 in. and is offset as shown.